University of Zurich[UZH]

Zurich Open Repository and Archive
University of Zurich
University Library
Strickhofstrasse 39
CH-8057 Zurich
www.zora.uzh.ch

Year: 2019

Prevention of orthodontic enamel demineralization: a systematic review with meta-analyses

Tasios, Thomas ; Papageorgiou, Spyridon N ; Papadopoulos, Moschos A ; Tsapas, Apostolos ; Haidich, Anna-Bettina

Abstract: Aim of this systematic review was to assess the efficacy of preventive interventions against the development of white spot lesions (WSLs) during fixed appliance orthodontic treatment. Nine databases were searched without limitations in September 2018 for randomized trials. Study selection, data extraction and risk of bias assessment were done independently in duplicate. Random-effects meta-analyses of mean differences (MDs) or relative risks (RRs) with their 95% confidence intervals (CIs) were conducted, followed by sensitivity analyses, and the GRADE analysis of the evidence quality. A total of 24 papers (23 trials) were included, assessing preventive measures applied either around orthodontic brackets (21 trials; 1427 patients; mean age 14.4 years) or molar bands (2 trials; 46 patients; age/sex not reported). Active patient reminders were associated with reduced WSL incidence on patient level compared to no reminder (3 trials; 190 patients; RR: 0.4; 95% CI: 0.31-0.64; Number Needed to Treat [NNT]: 3 patients), flat surface sealants were associated with reduced WSL incidence on tooth level than no sealant (5 trials; 2784 teeth; RR: 0.8; 95% CI: 0.63-0.95; NNT: 33 teeth), and fluoride varnish was associated with reduced WSL severity on tooth level (2 trials; 1160 teeth; MD: -0.32 points; 95% CI: -0.44 to -0.21 points). However, the quality of evidence was low according to GRADE, due to risk of bias. Some evidence indicates that active patient reminders and flat surface sealants or fluoride varnish around orthodontic brackets might be associated with reduced WSL burden, but further research is needed. Keywords: adverse effects; clinical trials; dental caries; evidence-based medicine; fixed appliances; systematic review.

DOI: https://doi.org/10.1111/ocr.12322

Posted at the Zurich Open Repository and Archive, University of Zurich
ZORA URL: https://doi.org/10.5167/uzh-186122
Journal Article
Accepted Version

Originally published at:
Tasios, Thomas; Papageorgiou, Spyridon N; Papadopoulos, Moschos A; Tsapas, Apostolos; Haidich, Anna-Bettina (2019). Prevention of orthodontic enamel demineralization: a systematic review with meta-analyses. Orthodontics craniofacial research, 22(4):225-235.
DOI: https://doi.org/10.1111/ocr.12322

TITLE PAGE

Prevention of orthodontic enamel demineralization: a systematic review with meta-analyses

Thomas Tasios[1,2] | Spyridon N. Papageorgiou[3] | Moschos A. Papadopoulos[4] | Apostolos Tsapas[5,6] | Anna-Bettina Haidich[1]

1 Department of Hygiene, Social-Preventive Medicine & Medical Statistics, Medical School, Aristotle University of Thessaloniki, Thessaloniki, Greece.

2 Private practice, Hengelo, The Netherlands.

3 Clinic of Orthodontics and Pediatric Dentistry, Center of Dental Medicine, University of Zurich, Switzerland.

4 Department of Orthodontics, Faculty of Dentistry, Aristotle University of Thessaloniki, Greece.

5 Clinical Research and Evidence-Based Medicine Unit, Second Medical Department, Aristotle University of Thessaloniki, Thessaloniki, Greece.

6 Second Medical Department, Ippokratio Hospital, Aristotle University of Thessaloniki, Thessaloniki, Greece.

Correspondence

Thomas Tasios, Department of Hygiene, Social-Preventive Medicine & Medical Statistics, Medical School, Aristotle University of Thessaloniki, Thessaloniki, Greece; e-mail: thomastasios@yahoo.gr.

Short title

Prevention of orthodontic white spot lesions

ORCID

Thomas Tasios: 0000-0002-7284-4726

Spyridon N. Papageorgiou: 0000-0003-1968-3326

Moschos A. Papadopoulos: 0000-0002-7630-7258

Apostolos Tsapas: 0000-0003-0221-4072

Anna-Bettina Haidich: 0000-0001-5100-8799

Funding Information

None.

Acknowledgements

None.

Conflict of interest

None. All authors declare that there are no conflicts of interest.

Characters in title (w spaces): 89

Words in Abstract: 258

Total word count (Manuscript): 3862

Total number of tables/figures: 6

Number of references: 55

Prevention of orthodontic enamel demineralization: a systematic review with meta-analyses

Abstract

Objective: To assess the efficacy of preventive interventions against the development of White Spot Lesions (WSLs) during fixed appliance orthodontic treatment.

Setting and sample population: Systematic review with meta-analysis.

Materials and Methods: Nine databases were searched without limitations in September 2018 for randomized trials. Study selection, data extraction, and risk of bias assessment was done independently in duplicate. Random-effects meta-analyses of Mean Differences (MDs) or Relative Risks (RRs) with their 95% Confidence Intervals (CIs) were conducted, followed by sensitivity analyses, and the GRADE analysis of the evidence quality.

Results: A total of 24 papers (23 trials) were included, assessing preventive measures applied either around orthodontic brackets (21 trials; 1427 patients; mean age 14.4 years) or molar bands (2 trials; 46 patients; age / sex not reported). Active patient reminders were associated with reduced WSL incidence on patient level compared to no reminder (3 trials; 190 patients; RR: 0.4; 95% CI: 0.31 to 0.64; Number Needed to Treat [NNT]: 3 patients), flat surface sealants were associated with reduced WSL incidence on tooth level than no sealant (5 trials; 2784 teeth; RR: 0.8; 95% CI: 0.63 to 0.95; NNT: 33 teeth), and fluoride-varnish was associated with reduced WSL severity on tooth level (2 trials; 1160 teeth; MD: -0.32 points; 95% CI: -0.44 to -0.21 points). However, the quality of evidence was low according to GRADE, due to risk of bias.

Conclusion: Some evidence indicates that active patient reminders and flat surface sealants or fluoride varnish around orthodontic brackets might be associated with reduced WSL burden, but further research is needed.

KEYWORDS

Fixed appliances; adverse effects; clinical trials; evidence-based medicine; dental caries; systematic review

BLINDED MANUSCRIPT

1 | INTRODUCTION

1.1 | Background

Orthodontic treatment with fixed appliances has been established as an integral part of contemporary orthodontics, due to its capacity for precisely planned tooth movements in all three planes. At the same time however, fixed appliances have been associated with adverse effects to the teeth and the surrounding structures including subgingival microbial changes,[1] clinical attachment loss,[2] root resorption,[3] tooth discoloration,[4] and tooth demineralization.[5] Among these, tooth demineralizations in the form of white spot lesions (WSLs) are prominent, as they have a negative impact on the esthetic outcome of orthodontic treatment and might even progress into carious lesions.[6]

The reported prevalence of WSLs varies considerably, depending on the measurement method/criteria, inclusion of pre-existing developmental enamel defects, and whether tooth surfaces, teeth or patients are used as reference unit. About every third treated patient (37 per cent) has at least one new post-orthodontic WSL,[7] whereas 24 per cent of treated teeth developed at least one WSL,[8] with the teeth most affected being the maxillary and mandibular first molars, maxillary lateral incisors, mandibular lateral incisors, and mandibular canines. Although treatment duration can influence the prevalence and severity of WSLs,[9] WSLs can also develop within the first 4 weeks of fixed appliance treatment.[5]

Several preventive measures have been suggested to avoid or reduce the development of WSLs during fixed appliance treatment, including fluoride-releasing glass ionomer cements for bonding and banding,[9] daily use of a fluoride mouthrinses,[10] and the use of lingual orthodontic appliances.[11] A previous Cochrane review[10] found that although such preventive measures during orthodontic treatment might be promising in the short term, robust evidence on their effect during the complete span of orthodontic treatment is lacking. However, this review included only 3 randomized clinical trials (RCT) that were published up to 2012 and could not perform any meta-analyses.

1.2 | Aim

Therefore, the aim of this systematic review was to critically assess the evidence derived from randomized clinical trials on humans undergoing orthodontic treatment to answer the question: Which

is the best intervention to prevent tooth demineralization in patients undergoing fixed appliance orthodontic treatment?

2 | MATERIALS AND METHODS

2.1 | Protocol and registration

The review's protocol was made a priori, registered in PROSPERO (CRD42017079352), and all post hoc changes were appropriately noted. This systematic review was conducted and reported according to Cochrane Handbook[12] and PRISMA statement,[13] respectively.

2.2 | Eligibility criteria

According to the Participants-Intervention-Comparison-Outcome-Study design (PICOS) schema and due to the scarcity of RCTs on this subject, included were randomized or quasi-randomized prospective controlled human trials that compare any intervention administered at treatment start aimed at preventing the development of WSLs compared to a control/placebo group or to another intervention. Included were both parallel and within-persons randomized trials on human patients of any age, sex, ethnicity, or malocclusion. No limitations concerning language, publication year, or status were applied. Excluded were non-clinical studies, retrospective studies, animal studies, and studies on interventions against WSL administered during or after orthodontic treatment.

2.3 | Information sources and literature search

A total of nine electronic databases were searched systematically by one author (SNP) without any limitations from inception up to September 20th, 2018 (Appendix Table 1). In addition, Directory of Open Access Journals (DOAJ), Digital Dissertations (searched via UMI ProQuest), metaRegister of Controlled Trials, WHO trials search portal, and Google Scholar were manually searched for additional trials or protocols by the same author. In addition, the reference lists and Google Scholar ® citation lists of eligible full text articles, as well as the reference lists of relevant systematic reviews were screened manually for additional studies.

2.4 | Study selection

Two review authors (TT and SNP) screened the titles and/or abstracts of studies retrieved from the searches and those from additional sources (hand searching, reference/citation lists) to identify articles that potentially meet the inclusion criteria. The full text of these potentially eligible trials, as well as of those abstracts which did not provide sufficient information to allow decision-making regarding inclusion or exclusion, were retrieved and assessed by one review author (TT), while a second one (SNP) independently checked the decisions. Any differences between the two reviewers was discussed and settled by consensus after consulting a third author (MAP).

2.5 | Data collection and data items

Data collection from the identified reports was conducted using pre-defined forms that were finalized and piloted by two authors (TT and SNP) prior to the end of the literature searches. The forms included: (i) study characteristics (design, clinical setting, country), (ii) patient characteristics (age, sex), (iii) oral hygiene protocol, (iv) other sources of fluoride, (v) applied intervention, (vi) analyzed sample, and (vii) outcome details (nature, measurement method, timing). Data were extracted by one author (TT), while a second author (SNP) read again the full texts of the included trials and independently re-extracted the data. Discrepancies between the two reviewers were settled by consensus after consulting a third author (MAP). Piloting of the forms was performed during the protocol stage until over 90 per cent agreement was reached. Data that were not described in the article were calculated from existing data, if possible.

2.6 | Risk of bias in individual trials

The risk of bias within included randomized trials was assessed on outcome level with the Cochrane risk of bias tool, according to the Cochrane Handbook for Systematic Reviews of Interventions 5.1.0.[12] Assessment of the risk of bias within individual trials was likewise performed by one author (TT) and independently checked by a second one (SNP), with the same way to resolve discrepancies consulting a third author (MAP).

2.7 | Outcomes and data synthesis

An effort was made to include all existing trials in the analysis independently of reporting completeness; where data was missing, they were calculated by ourselves or requested from the authors or calculated

from graphs (Supplementary Material). As the outcome of WSL development is bound to be affected by the initial tooth characteristics, used substance, application protocol, patient adherence to given instructions, and oral hygiene, a random-effects model was deemed appropriate to calculate the average distribution of true effects, based on clinical and statistical reasoning.[14] A restricted maximum likelihood random effects model instead of the older DerSimonian-Laird was chosen a priori, based on recent guidance.[15] Mean differences (MDs) for continuous outcomes and relative risks (RRs) for binary outcomes and their corresponding 95 % confidence intervals (CIs) were calculated as effect sizes. Statistically significant RRs were translated into Numbers Needed to Treat (NNTs) to gauge their clinical relevance.

The extent and impact of between-study heterogeneity was assessed by inspecting the forest plots and by calculating the τ^2 (absolute heterogeneity) and the I^2 statistics (relative heterogeneity), respectively. I^2 defines the proportion of total variability in the result explained by heterogeneity, and not chance and we considered arbitrarily I^2 over 75% to represent considerable heterogeneity, while also considering the heterogeneity's direction (localization on the forest plot) and uncertainty intervals around heterogeneity estimates.[16] Ninety-five per cent predictive intervals were calculated for meta-analyses of ≥3 trials to incorporate existing heterogeneity and provide a range of possible effects for a future clinical setting, which are crucial for the correct interpretation of random-effects meta-analyses.[17]

All analyses were run in Stata version 14.0 (StataCorp LP, College Station, TX) by one author (SNP) and the dataset was openly provided through Zenodo.[18] All P values were two-sided with $\alpha = 5$ %, except for the test of between-studies or between-subgroups heterogeneity where α-value was set as 10 %.[19]

2.8 | Additional analyses, risk of bias across studies, and quality of evidence

Possible sources of heterogeneity were a priori planned to be sought through subgroup analyses and random-effects meta-regression in meta-analyses of at least 5 trials, but could ultimately not be performed (Supplementary Material). Likewise, reporting biases were planned to be assessed in meta-analyses of at least 10 trials, but could ultimately not, due to the limited number of meta-analyzed trials.

The overall quality of meta-evidence (i.e. the strength of clinical recommendations) was rated using the Grades of Recommendations, Assessment, Development, and Evaluation (GRADE) approach, as very low, moderate, or high[20] and Summary of Findings tables were constructed using

the improved format proposed by Carrasco-Labra et al.[21] The minimal clinical important, large, and very large effects were defined as half, one, and two standard deviations of the post-treatment response (for continuous outcomes) and RRs of 1.5, 2.0, and 5.0 (for binary outcomes).[22,23] The produced forest plots were augmented with contours denoting the magnitude of the observed effects[24] to assess heterogeneity, clinical relevance, and imprecision.

2.9 | Sensitivity analyses

Robustness of the results was planned a priori to be checked with sensitivity analyses based on (i) inclusion/exclusion of trials with methodological shortcomings, (ii) improvement of the GRADE classification, and (iii) inclusion/exclusion of within-person randomized trials. In the end, two sensitivity analyses could be conducted, including only trials with low risk of bias for generation of the randomization sequence and for blind outcome assessment.

3 | RESULTS

3.1 | Study selection

The electronic literature search yielded 1321 results, while another two were manually identified from the reference/citation lists of identified papers (Figure 1; Appendix Table 1). After duplicate removal and screening the titles/abstracts of identified reports, the full texts of 252 papers were checked against the eligibility criteria. Ultimately, 24 papers were finally included in the meta-analyses, which pertained to 23 unique trials (21 trials on incisors/canines/premolars with bonded brackets and 2 trials on banded molars). Due to their clear distinction regarding used materials and biology/prevalence of WSLs between bracketed/banded teeth, these were assessed separately.

3.2 | Study characteristics

The study characteristics are presented in Table 1 and Appendix Table 3. The trials where conducted in 8 different countries, while 17 (74%) of them were cluster- (within-persons) randomized studies and 6 (26%) of them parallel randomized. Most of the studies took place in an academic environment (70%). The bracket-group studies included in total 1427 patients (mean: 68, range: 10-298) that were 40.7% male (223 male patients out of the 548 patients in the 12/21 studies reporting sex) and had an average age of 14.4 years (from the 13/21 studies reporting age). The band-group studies included 46 patients

(mean: 23, range: 18-28), but neither of the two studies reported patient sex or gender. In the total 23 studies, a wide range of fluoride sources were reported either in combination with the oral hygiene instructions such as fluoride mouthwash, fluoride toothpaste or as supplamentary fluoride sources such as fluoride in the drinking water and fluoride-releasing elastomeric ligatures. The variety of the interventions applied to prevent the formation of WSLs were different types of adhesives, sealants or varnishes and the use of mobile-phone applications and messaging to encourage patient motivation.

3.3 | Risk of bias within studies

The risk of bias assessment of the 23 included studies are presented in summary format in Figure 2. Sixteen (70%) of the trials were found to be in high risk of bias for at least one of the bias domains. The most problematic domains were found to be blinding of outcome assessment (10 trials; 43%), selective outcome reporting (9 trials; 39%), and generation of the random sequence generation (6 trials; 26%). The detailed assessment according to the Cochrane Risk of Bias tool can be found in Appendix Tables 4a and 4b.

3.4 | Results of individual studies and data synthesis

The results of all individual trials being meta-analyzed and the meta-analytical overall estimates can be found in Figure 3, Appendix Figures 1-8, Table 2, and Appendix Table 5. Seven different meta-analyses could be performed from trials on bracketed teeth which examined WSL development (on patient or tooth level), the WSL area changes (on tooth level), and WSL index (on tooth level) (Figure 3, Table 2). A meta-analysis of three parallel randomized trials indicated that active patient reminders were effective in reducing the number of patients with WSLs (RR=0.44; 95% CI=0.31 to 0.64; P<0.001; I^2=0%), which translated to a very efficient NNT of 3 patients needed to treat. In addition, meta-analysis of 5 within-persons randomized trials indicated that the use of flat surface sealants around the brackets was effective in reducing WSL development on tooth level (RR=0.77; 95% CI=0.63 to 0.95; P=0.01; I^2=50%), which however corresponded to a very large NNT of 33 teeth needed to treat. Finally, a meta-analysis of 2 within-persons randomized trials indicated that the use of a fluoride varnish on the tooth surface was significantly associated with smaller WSL area (MD=-0.32 mm^2; 95% CI=-0.44 to -0.21 mm^2; P<0.001; I^2=0%).

One meta-analysis could be performed from 2 within-persons randomized trials on banded molars, which examined the WSL development on tooth level, but found no significant protective role from the use of a fluoride varnish under the band's cement (Appendix Table 5).

No adverse effects were reported in any of the studies, but this can also be subject to selective reporting of trial results, as none of the included trials provided a pre-registered protocol.

3.5 | Additional analyses, risk of bias across studies, and quality of evidence

Several subgroup analyses, meta-regressions, and assessments for reporting biases were originally planned in the review's protocol, but could ultimately not be performed due to limited data and inadequate reporting (Supplementary material).

The quality of evidence for the 7 meta-analyses on bracketed teeth ranged from high to very low, as methodological limitations, inconsistency, and imprecision were identified on some cases (Table 3 and Appendix Table 6a). All three meta-analyses with significant WSL-preventive measures (patient reminders, sealants, and fluoride varnishes) were supported by evidence of low quality, due to methodological inadequacies of the included trials that puts them in risk of bias. A GRADE rating of very low confidence was assigned on the findings of the single meta-analysis on banded molars, due to methodological limitations, inconsistency, and imprecision (Appendix Tables 6b and 7).

3.6 | Sensitivity analysis

The sensitivity analyses indicated relative robustness of the results according to randomization and blinding problems, apart from the observed reduced statistical power of the sensitivity analyses, which was expected after omitting trials (Appendix Table 8).

4 | DISCUSSION

4.1 | Summary of evidence

The current systematic review summarizes evidence from randomized trials on preventive measures against WSL development during orthodontic treatment with fixed appliances. Out of the initially identified 1323 hits from the literature search, 23 trials (involving 1473 patients) were ultimately included in the quantitative synthesis (meta-analysis). Another 33 trials were identified as potentially eligible for inclusion, but could not contribute to the meta-analyses, as they investigated diverse combinations of

treatment comparisons and measured different outcomes (Figure 1 and Appendix Table 2). Therefore, the present review focused on the more robust clinical recommendations that could be supported from meta-analyses of at least two meta-analyzed trials, including several new studies published after 2012 that were unavailable to previous reviews.

The pathogenetic mechanism of dental enamel decalcification requires undoubtedly the presence of the structurally organized dental biofilm as a means of converting the food glucose into acidic products. However, the multifactorial nature of the disease assumes that the increased or reduced presence of dental plaque does not translates per se into respective high or low level of WSL incidence.[25] Unlike other studies[26,27] the purpose of our review was to evaluate the more clinically relevant outcome of WSL development which in fact has an impact on the final esthetic outcome and on the integrity of dental structure. In addition, according to our protocol we intended to include also the esthetic assessment of the teeth and WSL by laypersons or patients but without success due to no availability of current data.

Three of the eight performed meta-analyses indicated statistically significant benefits in terms of reduced WSL development or severity (Table 2 and Appendix Table 5). First, active patient reminders via mobile texts or apps were associated in a meta-analysis of 3 parallel randomized trials to reduced WSL prevalence (RR=0.44; 95% CI=0.31 to 0.64; P<0.001; I^2=0%) which is translated into a clinically relevant NNT of 3 patients. The introduction of cellphone technology has had a tremendous effect on human lifestyle and the current results indicate that it could possibly be also incorporated in the orthodontist's armamentarium against WSLs. This is in agreement with two previous reviews that also highlighted the possible benefit of active reminders in the fight against WSLs.[28,29] This might be attributed to the well-documented improvement in plaque accumulation and gingival score of patients in the active reminder group, since these are relevant to the WSLs' pathogenetic mechanism. However, these results should be approached with concern (even though they convey a clinically relevant benefit), since the quality of evidence according to GRADE approach is low (Table 3), due to the fact that two of the three included trials had not employed blind outcome assessment (Appendix Figure 1). This means that future studies are needed to cement our confidence on the protective role of active patient reminders against WSL development.

The use of flat surface sealants emerged likewise as an effective measure in the prevention of WSLs during orthodontic treatment. Dental sealants have been widely used to to create a protective

film on pits and fissures of various teeth[30,31] and their use has been subsequently proposed also for the protection of flat tooth surfaces during orthodontic treatment. A wide variety of such orthodontic flat surface sealants exists that either include fluoride or not[32] and are applied either before or after bracket placement.[33-38] Nevertheless, this is to our knowledge the first systematic review to systematically assess the performance of such flat surface sealants during orthodontic treatment in an evidence-based manner. Meta-analysis of 5 included within-persons randomized trials showed that sealants had a significant protective effect on tooth level (RR=0.77; 95% CI=0.63 to 0.95; P=0.01; I^2=50%; Table 2). However, this is translated into an NNT of 33 teeth, which (taking on average 20 teeth bonded per patient) indicates that not each patient might necessarily benefit from this. Additionally, the GRADE analysis yielded low quality of evidence for this recommendation, which means that future trials on sealants might change current recommendations.

In the fight against demineralization and dental caries fluoride holds a prominent position, due to the increased resistance of fluoridated hydroxyapatite to acidic environments compared to initially formed hydroxyapatite.[25] Therefore, fluoride-fortifying measures have long been established as effective weapons against carious lesions.[39-41] In the current review, meta-analysis of 2 within-persons randomized trials indicated that fluoride varnish was associated with reduced WSL area on the tooth surface (MD=-0.32 mm^2; 95% CI=-0.44 to -0.21 mm^2; P<0.001; I^2=0%; Appendix Figure 7), the clinical relevance of which might be questioned. Additionally, we could not find a nominally statistically significant effect of fluoride varnishes on WSL development on patient level (RR=0.49; 95% CI=0.18 to 1.15; P=0.10; I^2=85%). However, both meta-analyzed trials were consistent on the protective tendency of fluoride varnish, but provided effect of heterogenous magnitude that ultimately led to a very imprecise summary estimate. This uncertainty is mirrored in the low to very low quality of evidence according to GRADE and it might well be that future trials enhance our confidence about the efficacy of fluoride varnishes in the prevention of orthodontic WSLs. The same uncertainty exists in the efficacy of fluoride in the treatment of post-orthodontic WSLs, where despite statistical significant results, their clinical relevance remains questionable.[42] Fluoride-releasing and glass-ionomer bracket adhesives have also been introduced to the market in order to utilize the beneficial effects of fluoride against demineralization. However, our data syntheses could not prove any statistically significant improvement when compared with conventional and resin adhesives (Table 2). Finally, very low quality of data

synthesized from two studies could not show any advantage in the use of fluoride varnish under molar bands (Appendix Table 5).

As far as patient follow-up in the included trials is concerned, most of them assessed WSLs mid-treatment or directly post-debond. A number of studies have examined the progress of WSLs after the removal of fixed orthodontic appliances and have observed a spontaneous improvement of orthodontic WSLs without any additional intervention but regular oral hygiene with a fluoride toothpaste,[43-46] which may continue even one year post-debonding. Thus, it might well be that a miniscule short-term efficacy of a specific measure might diminish in the long term, due to this spontaneous self-improvement. Unfortunately, the current evidence base cannot be used to formulate any recommendations about the long-term performance of WSL-preventive measures and future studies should focus on this.

4.2 | Strengths and limitations

This systematic review has several strengths, which include its a priori registered protocol,[47] its comprehensive literature search, the sole inclusion of randomized trials,[48] the use of modern analytic methods,[15] application of the GRADE approach to assess the strength of provided recommendations,[20] and the transparent provision of all data.[18] Finally, this review builds up on the recommendation from a previous Cochrane review[10] that based on one trial suggested fluoride varnishes might be effective in preventing orthodontically-induced WSLs. The current review confirmed the recommendation for fluoride varnishes by adding another trial and found that both flat surface sealants and active patient reminders might also be effective in reducing orthodontically-induced WSLs (based on 5 and 3 trials, respectively).

At the same time, some limitations also exist in the present review. First, most meta-analyses were based predominantly on small trials, which might affect their results.[49] Second, the vast majority of within-persons randomized trials did not take clustering into account and this can lead to biased estimates,[50-51] while their data were not available[52] to allow proper re-analysis. Third, many included studies assessed WSL prevalence during treatment and not at debond or post-debond, which might affect the prevalence/severity of observed WSLs,[9] although WSLs can also develop within the first 4 weeks of fixed appliance treatment.[5] Finally, the small number of trials that were ultimately included in the meta-analyses and their poor reporting of potential confounders like level of oral hygiene,

compliance, or method used to assess WSLs precluded the conduct of many analyses for subgroups, meta-regressions, and reporting bias that were initially planned (Supplementary material).

5 | CONCLUSIONS

Based on currently available evidence from randomized clinical trials, active patient reminders, flat surface sealants, and fluoride varnishes are associated with reduced development and magnitude of WSLs during orthodontic treatment with fixed appliances. However, the strength of these recommendations is mostly low, due to the inclusion of few small randomized trials in each meta-analysis, while many of the included trials did not assess WSL at debond or later. This means that future randomized trials might radically change existing recommendations concerning the prevention of orthodontically-induced WSLs and might at the same time enable the conduct of network meta-analysis to rank all preventive measures according to their performance.

Future trials should ideally focus on the long-term post-debond performance of preventive measures and employ blinded outcome assessment. Additionally, aspects that need to be improved in future trials of WSL prevention include a priori registration of the trials protocol.[54] This along with open provision of the trials' dataset will enhance the transparency and repeatability of research.[55] It is also important that future within-persons randomized trials properly analyze data taking clustering into account in order to provide more precise estimates of efficacy.[50,51] Finally, patient-related outcomes, such as the esthetic perception of WSLs by patients and orthodontists, might be helpful in order to assess the impact of orthodontically-induced WSL and their prevention on a more pragmatic scale.

REFERENCES

1. Papageorgiou SN, Xavier GM, Cobourne MT, Eliades T. Effect of orthodontic treatment on the subgingival microbiota: A systematic review and meta-analysis. *Orthod Craniofac Res*. 2018;21(4):175-185.
2. Papageorgiou SN, Papadelli AA, Eliades T. Effect of orthodontic treatment on periodontal clinical attachment: a systematic review and meta-analysis. *Eur J Orthod*. 2018;40(2):176-194.
3. Samandara A, Papageorgiou SN, Ioannidou-Marathiotou I, Kavvadia-Tsatala S, Papadopoulos MA. Evaluation of orthodontically induced external root resorption following orthodontic treatment using cone beam computed tomography (CBCT): a systematic review and meta-analysis. *Eur J Orthod*. 2019;41(1):67-79.
4. Kamber R, Papageorgiou SN, Eliades T. Does orthodontic treatment have a permanent effect on tooth color? : A systematic review and meta-analysis. *J Orofac Orthop*. 2018;79(2):73-82.
5. Ogaard B, Rølla G, Arends J. Orthodontic appliances and enamel demineralization. Part 1. Lesion development. *Am J Orthod Dentofacial Orthop*. 1988;94(1):68-73.
6. Gorelick L, Geiger AM, Gwinnett AJ. Incidence of white spot formation after bonding and banding. *Am J Orthod*. 1982;81(2):93-98.
7. Willmot DR, Brook AH. The incidence of post-orthodontic demineralized enamel lesions in an orthodontic clinic. *J Dent Res*. 1999;78(5):1049.
8. Mizrahi E. Surface distribution of enamel opacities following orthodontic treatment. *Am J Orthod*. 1983;84(4):323-331.
9. Marcusson A, Norevall LI, Persson M. White spot reduction when using glass ionomer cement for bonding in orthodontics: a longitudinal and comparative study. *Eur J Orthod*. 1997;19(3):233-242.
10. Benson PE, Parkin N, Dyer F, Millett DT, Furness S, Germain P. Fluorides for the prevention of early tooth decay (demineralised white lesions) during fixed brace treatment. *Cochrane Database Syst Rev*. 2013;(12):CD003809.
11. Papageorgiou SN, Gölz L, Jäger A, Eliades T, Bourauel C. Lingual vs. labial fixed orthodontic appliances: systematic review and meta-analysis of treatment effects. *Eur J Oral Sci*. 2016;124(2):105-118.
12. Higgins JPT, Green S. Cochrane handbook for systematic reviews of interventions. Version 5.1.0

(updated March 2011). The Cochrane Collaboration, 2011. Retrieved from http://www.cochranehandbook.org

13. Liberati A, Altman DG, Tetzlaff J, Mulrow C, Gøtzsche PC, Ioannidis JP, Clarke M, Devereaux PJ, Kleijnen J, Moher D. The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: explanation and elaboration. *J Clin Epidemiol*. 2009;62(10):e1-34.
14. Papageorgiou SN. Meta-analysis for orthodontists: Part I--How to choose effect measure and statistical model. *J Orthod*. 2014;41(4):317-326.
15. Langan D, Higgins JPT, Jackson D, Bowden J, Veroniki AA, Kontopantelis E, Viechtbauer W, Simmonds M. A comparison of heterogeneity variance estimators in simulated random-effects meta-analyses. *Res Synth Methods*. 2019;10(1):89-98.
16. Higgins JP, Thompson SG, Deeks JJ, Altman DG. Measuring inconsistency in meta-analyses. *BMJ*. 2003;327(7414):557-560.
17. IntHout J, Ioannidis JPA, Rovers MM, Goeman JJ. Plea for routinely presenting prediction intervals in meta-analysis. *BMJ Open*. 2016;6(7):e010247.
18. Tasios T, Papageorgiou S, Papadopoulos M, Tsapas A, Haidich A. Interventions for the prevention of white spot lesions during fixed orthodontic treatment: a systematic review of the literature and meta-analysis [Data set]. Zenodo, 2018. http://doi.org/10.5281/zenodo.2203812.
19. Ioannidis JPA. Interpretation of tests of heterogeneity and bias in meta-analysis. *J Eval Clin Pract*. 2008;14(5):951-957.
20. Guyatt GH, Oxman AD, Schünemann HJ, Tugwell P, Knottnerus A. GRADE guidelines: a new series of articles in the Journal of Clinical Epidemiology. *J Clin Epidemiol*. 2011;64(4):380-382.
21. Carrasco-Labra A, Brignardello-Petersen R, Santesso N, Neumann I, Mustafa RA, Mbuagbaw L, Etxeandia Ikobaltzeta I, De Stio C, McCullagh LJ, Alonso-Coello P, et al. Improving GRADE evidence tables part 1: a randomized trial shows improved understanding of content in summary of findings tables with a new format. *J Clin Epidemiol*. 2016;74:7-18.
22. Norman GR, Sloan JA, Wyrwich KW. Interpretation of Changes in Health-related Quality of Life. *Med Care*. 2003;41(5):582-592.
23. Schünemann H, Brozek J, Oxman A, editors. GRADE handbook for grading quality of evidence and strength of recommendation. version 3. The GRADE Working Group, 2009.

https://gradepro.org/handbook/

24. Papageorgiou SN. Meta-analysis for orthodontists: Part II--Is all that glitters gold? *J Orthod*. 2014;41(4):327-336.
25. Selwitz RH, Ismail AI, Pitts NB. Dental caries. *Lancet*. 2007;369(9555):51-59.
26. de Almeida CM, da Rosa WLO, Meereis CTW, de Almeida SM, Ribeiro JS, da Silva AF, Lund RG. Efficacy of antimicrobial agents incorporated in orthodontic bonding systems: a systematic review and meta-analysis. *J Orthod*. 2018;45(2):79-93.
27. Kalf-Scholte SM, Van der Weijden GA, Bakker E, Slot DE. Plaque removal with triple-headed vs single-headed manual toothbrushes-a systematic review. *Int J Dent Hyg*. 2018;16(1):13-23.
28. Lima IFP, de Andrade Vieira W, de Macedo Bernardino Í, Costa PA, Lima APB, Pithon MM, Paranhos LR. Influence of reminder therapy for controlling bacterial plaque in patients undergoing orthodontic treatment: A systematic review and meta-analysis. *Angle Orthod*. 2018;88(4):483-493.
29. Mohammed H, Rizk MZ, Wafaie K, Ulhaq A, Almuzian M. Reminders improve oral hygiene and adherence to appointments in orthodontic patients: a systematic review and meta-analysis. *Eur J Orthod*. 2019;41(2):204-213.
30. Wright JT, Crall JJ, Fontana M, Gillette EJ, Nový BB, Dhar V, Donly K, Hewlett ER, Quinonez RB, Chaffin J, et al. Evidence-based clinical practice guideline for the use of pit-and-fissure sealants: A report of the American Dental Association and the American Academy of Pediatric Dentistry. *J Am Dent Assoc*. 2016;147(8):672-682.e12.
31. Papageorgiou SN, Dimitraki D, Kotsanos N, Bekes K, van Waes H. Performance of pit and fissure sealants according to tooth characteristics: A systematic review and meta-analysis. *J Dent*. 2017;66:8-17.
32. Wenderoth CJ, Weinstein M, Borislow AJ. Effectiveness of a fluoride-releasing sealant in reducing decalcification during orthodontic treatment. *Am J Orthod Dentofacial Orthop*. 1999;116(6):629-634.
33. Banks PA, Richmond S. Enamel sealants: A clinical evaluation of their value during fixed appliance therapy. *Eur J Orthod*. 1994;16(1):19-25.
34. Fornell A-C, Sköld-Larsson K, Hallgren A, Bergstrand F, Twetman S. Effect of a hydrophobic tooth coating on gingival health, mutans streptococci, and enamel demineralization in

adolescents with fixed orthodontic appliances. *Acta Odontol Scand*. 2002;60(1):37-41.

35. Benham AW, Campbell PM, Buschang PH. Effectiveness of pit and fissure sealants in reducing white spot lesions during orthodontic treatment. A pilot study. *Angle Orthod*. 2009;79(2):338-345.
36. Bechtold TE, Sobiegalla A, Markovic M, Berneburg M, Göz GR. In vivo effectiveness of enamel sealants around orthodontic brackets. *J Orofac Orthop*. 2013;74(6):447-457.
37. O'Reilly MT, De Jesús Viñas J, Hatch JP. Effectiveness of a sealant compared with no sealant in preventing enamel demineralization in patients with fixed orthodontic appliances: a prospective clinical trial. *Am J Orthod Dentofacial Orthop*. 2013;143(6):837-844.
38. Hammad SM, Knösel M. Efficacy of a new sealant to prevent white spot lesions during fixed orthodontic treatment : A 12-month, single-center, randomized controlled clinical trial. *J Orofac Orthop*. 2016;77(6):439-445.
39. Wong MC, Clarkson J, Glenny AM, Lo EC, Marinho VC, Tsang BW, Walsh T, Worthington HV. Cochrane reviews on the benefits/risks of fluoride toothpastes. *J Dent Res*. 2011;90(5):573-9.
40. Marinho VC, Worthington HV, Walsh T, Chong LY. Fluoride gels for preventing dental caries in children and adolescents. *Cochrane Database Syst Rev*. 2015;(6):CD002280.
41. Marinho VC, Chong LY, Worthington HV, Walsh T. Fluoride mouthrinses for preventing dental caries in children and adolescents. *Cochrane Database Syst Rev*. 2016;7:CD002284.
42. Höchli D, Hersberger-Zurfluh M, Papageorgiou SN, Eliades T. Interventions for orthodontically induced white spot lesions: a systematic review and meta-analysis. *Eur J Orthod*. 2017;39(2):122-133.
43. Ogaard B, Ten Bosch JJ. Regression of white spot enamel lesions. A new optical method for quantitative longitudinal evaluation in vivo. *Am J Orthod Dentofacial Orthop*. 1994;106(3):238-242.
44. Al-Khateeb S, Forsberg CM, de Josselin de Jong E, Angmar-Månsson B. A longitudinal laser fluorescence study of white spot lesions in orthodontic patients. *Am J Orthod Dentofacial Orthop*. 1998;113(6):595-602.
45. Willmot DR. White lesions after orthodontic treatment: does low fluoride make a difference? *J Orthod*. 2004;31(3):235-242.
46. van der Veen MH, Mattousch T, Boersma JG. Longitudinal development of caries lesions after orthodontic treatment evaluated by quantitative light-induced fluorescence. *Am J Orthod*

Dentofacial Orthop. 2007;131(2):223-228.

47. Sideri S, Papageorgiou SN, Eliades T. Registration in the international prospective register of systematic reviews (PROSPERO) of systematic review protocols was associated with increased review quality. *J Clin Epidemiol*. 2018;100:103-110.
48. Papageorgiou SN, Xavier GM, Cobourne MT. Basic study design influences the results of orthodontic clinical investigations. *J Clin Epidemiol*. 2015;68(12):1512-1522.
49. Cappelleri JC, Ioannidis JP, Schmid CH, de Ferranti SD, Aubert M, Chalmers TC, Lau J. Large trials vs meta-analysis of smaller trials: how do their results compare? *JAMA*. 1996;276(16):1332-1338.
50. Koletsi D, Pandis N, Polychronopoulou A, Eliades T. Does published orthodontic research account for clustering effects during statistical data analysis? *Eur J Orthod*. 2012;34(3):287-292.
51. Efthimiou O, Mavridis D, Nikolakopoulou A, Rücker G, Trelle S, Egger M, Salanti G. A model for meta-analysis of correlated binary outcomes: The case of split-body interventions. *Stat Methods Med Res*. 2017:962280217746436.
53. Papageorgiou SN, Cobourne MT. Data sharing in orthodontic research. J Orthod. 2018;45(3):1-3.
54. Dwan K, Gamble C, Williamson PR, Kirkham JJ; Reporting Bias Group. Systematic review of the empirical evidence of study publication bias and outcome reporting bias - an updated review. *PLoS One*. 2013;8(7):e66844.
55. Ioannidis JPA. How to Make More Published Research True. *PLoS Med*. 2014;11(10):e1001747.

Figure Legends

FIGURE 1 PRISMA flowdiagram for study identification and selection.

FIGURE 2 Risk of bias summary for the included randomized trials.

FIGURE 3 Contour-enhanced forest plot summary of all performed random-effects meta-analyses (REML method). CI, confidence interval; F, fluoride; GRADE, Grades of Recommendations, Assessment, Development, and Evaluation; pat, patient-level; PrI, predictive interval; RR, relative risk; tth, tooth-level; VS, versus; WSLdev, white spot lesion development.

TABLE 1 Characteristics of included trials on bracketed teeth

Study	Design; Setting; Country*	Patients (M/F); age†	OH	F sources	Intervention
Allabdullah 2017	wpRCT; Uni; SYR	G1/2: 30 (13/17); 17.6	OHI	No topical fluoridation	G1: F-ADH G2: CTR
Banks 1994	wpRCT; Hosp; GBR	G1/2/3: 80 (NR); NR	OHI	No F supplementation	G1: SEAL1 G2: SEAL2 G3: CTR
Banks 1997	wpRCT; Hosp; GBR	G1/2: 50 (NR/NR); NR	OHI	F-MWASH (R)	G1: F-ADH G2: CTR
Benham 2009	wpRCT; Uni; USA	G1/2: 60(30/30); (11.0-16.0)	OHI	-	G1: SEAL G2: CTR
Eppright 2014	pRCT; Uni; USA	G1: 21 (NR/NR); 14.7 G2: 21 (NR/NR); 13.7	OHI + kit	1 x F-MWASH (P)	G1: Active reminder G2: CTR
Fornell 2002	wpRCT; clinic; SWE	G1/2: 40 (17/23); 14.5	-	-Low F drinking water level -Use of F-TPAS twice /day	G1: SEAL G2: CTR
Gaworski 1999	wpRCT; Uni; USA	G1/2: 16 (NR); NR	-	-	G1: ADH 1 (GI) G2: ADH 2 (CR)
Jejurikar 2014	pRCT; Uni; IND	G1: 25 (NR); NR G2: 25 (NR); NR	OHI	-	G1: Active reminder G2: CTR
Kumar Jena 2015	wpRCT; Uni; IND	G1/2: 40 (20/20);15.5	-	-F-TPAS (R) -No other F sources	G1: Varnish (RMGI) G2: CTR
Kumar 2018	pRCT; Uni; IND	G1: 30 (16/14); 16.3 G2: 30 (12/18); 15.3	OHI	-F-TPAS/-MWASH (R) in G1	G1: Active reminder G2: CTR
Marcusson 1997	wpRCT; Uni; SWE	G1/2: 60 (21/39); 13.7	OHI	-F-TPAS (I) -F-level in driking water 0.2 ppm	G1: ADH 1 (GI) G2: ADH 2 (CR)
Millett 1999	wpRCT; Uni; GBR	G1/2: 40 (17/23); 13.4	OHI	-F-TPAS (R)	G1: ADH 1 (GI) G2: ADH 2 (CR)
Mitchell 1992	wpRCT; Uni; GBR	G1/2: 24 (6/18); 14.4	-	-	G1: F-ADH G2: CTR
Ogaard 1997; 2001	pRCT; Pract; SWE	G1: 101 (NR); NR G2: 97 (NR); NR G3: 100 (NR); NR	-	-T-PAS (1500 ppm F) (P) -No other F sources	G1: F-varnish + CHX-varnish G2: F-varnish + Placebo varnish G3: CTR
O'Reilly 2013	wpRCT; Pract; USA	G1/2: 62 (19/43); 14.6	-	-F-TPAS (R) -F-supplementation for WSLs -F-ADH / F-elastic ties allowed	G1: SEAL G2: CTR
Stecksen-Blicks 2007	pRCT; clinic; SWE	G1: 137 (NR); NR G2: 136 (NR); NR	-	-F in drinking water of 0.2 ppm -F-TPAS (1000-1500 ppm) (R)	G1: F-varnish G2: Placebo varnish
Trimpeneers 1996	wpRCT; Uni; BEL	G1/2: 50 (NR); 12.8	NR	NR	G1: F-ADH (CR) G2: CTR (CR)
Turner 1993	wpRCT; NR; GRB	G1/2: 42 (13/29); 14.4	-	-	G1: F-ADH (CR) G2: CTR (CR)
Vivaldi-Rodrigues 2006	wpRCT; Uni; BRA	G1/2: 10 (5/5); (10.0-14.0)	OHI	NR	G1: F-varnish G2: CTR
Wenderoth 1999	wpRCT; Uni; USA	G1/2: 20 (NR); 13.2	OHI	NR	G1: F-SEAL G2: CTR
Zotti 2016	pRCT; Uni; ITA	G1: 40 (17/23); 14.1 G2: 40 (17/23); 13.6	OHI + kit	NR	G1: OH mobile application G2: CTR

* countries are given with their ISO ALPHA-3 codes
† age is given either as mean (one number) or when mean is unavailable as range (in parenthesis)—all in years
‡ mean age pertains to the initial sample with an additional patient that dropped out
§ Data after drop-outs
£ Reported as medians and not means

ADH, adhesive; BRACK, bracket; CHX, chlorhexidine; CR, composite resin; CTR, control/conventional; G, group; GI, glass ionomer; Hosp, hospital; MWASH, mouthwash; NACP, nano amorphous calcium phosphate; NR, not reported; OH, oral hygiene; Pract, private practice; pRCT, parallel randomized clinical trial; QLF, Quantitative Light-induced Fluorescence; RMGI, resin modified glass ionomer; SE, selft-etching; SEAL, sealant; SL, self-ligating; TBRUS, toothbrush; TPAS, toothpaste; Uni, university clinic; wpRCT, within-persons randomized clinical trial; yr, year.

TABLE 2 Results of meta-analyses with at least 2 studies on bracketed teeth

Experimental group	Control group	n	Outcome	Follow-up (mos)	Effect (95% CI)	P	I^2 (95% CI)	τ^2 (95% CI)	95% PrI
Reminder	No reminder	3	WSL development (Pat-level)	3.0-12.0	RR: 0.44 (0.31 to 0.64)	<0.001	0% (0 to 86%)	0 (0 to 0.66)	0.04 to 4.91
F-releasing adhesive	Conventional adhesive	5	WSL development (Tth-level)	10.5-21.0	RR: 0.86 (0.70 to 1.07)	0.18	4% (0 to 83%)	0 (0 to 0.29)	0.59 to 1.27
F-releasing adhesive	Conventional adhesive	2	WSL area (Tth -level)	10.5-12.0	MD: -0.23 (-0.85 to 0.38)	0.46	0% (0 to 99%)	0 (0 to 43.86)	-
Glass-ionomer adhesive	Resin adhesive	3	WSL development (Tth -level)	13.0-22.0	RR: 0.81 (0.47 to 1.39)	0.44	73% (0 to 99%)	0.16 (0 to 3.97)	0 to >100.0
Any sealant	No sealant	5	WSL development (Tth -level)	12.8-26.7	RR: 0.77 (0.63 to 0.95)	0.01	50% (0 to 97%)	0.02 (0 to 0.68)	0.42 to 1.41
F-varnish	No varnish	2	WSL development (Pat -level)	NR	RR: 0.46 (0.18 to 1.15)	0.10	85% (0 to 100%)	0.38 (0 to 56.63)	-
F-varnish	No varnish	2	WSL area (Tth -level)	6.0	MD: -0.32 (-0.44 to -0.21)	<0.001	0% (0 to 98%)	0 (0 to 1.48)	-

CI, confidence interval; F, fluoride; MD, mean difference; mo, month; NR, not reported; Pat, patient; PrI, prediction interval; RR, relative risk; Tth, tooth; WSL, white spot lesion.

TABLE 3 Summary of findings table according to the GRADE approach on bracketed teeth

		Anticipated absolute effects[a] (95% CI)				
Outcome Trials (patients)	**Relative effects (95% CI)**	**Control**	**Experimental**	**Difference**	**Quality of the evidence (GRADE)[c]**	**What happens**
		No reminder	Active reminder			
WSL development (pat.-level) 3.0-12.0 months 190 pats (3 pRCTs)	RR 0.4 (0.31 to 0.64)	59.6%[b]	26.2% (18.5 to 38.1)	33.4% less patients (21.5 to 41.1 less) NNT of 3	⊕⊕◯◯ low[d] due to bias	Reminders might probably decrease the number of patients with WSLs
		Control adhesive	F-releasing adhesive			
WSL development (tth.-level) 10.5-21.0 months 2142 tth (5 wpRCTs)	RR 0.9 (0.70 to 1.07)	15.8%[b]	13.6% (11.1 to 16.9)	2.2% less teeth (4.7 less to 1.1 more) NNT -	⊕⊕◯◯ low[d] due to bias	Probably little to no difference in WSL development on teeth
WSL area (tth.-level) 10.5-12.0 months 135 tth (2 wpRCTs)	-	1.8 mm^2	-	0.2 mm^2 smaller area (0.85 mm^2 smaller to 0.38 mm^2 greater)	⊕⊕⊕⊕ high	Little to no difference in WSL area on teeth
		Resin adhesive	Glass-ionomer adhesive			
WSL development (tth.-level) 13.0-22.0 months 451 tth (3 wpRCTs)	RR 0.8 (0.47 to 1.39)	39.1%[b]	31.7% (18.4 to 54.3)	7.4% less teeth (20.7 less to 15.2 more) NNT -	⊕◯◯◯ very low[d,e] due to bias, imprecision	There might be little to no difference in WSL development on teeth
		No sealant	Any sealant			
WSL development (tth.-level) 12.8-26.7 months 2784 tth (5 wpRCTs)	RR 0.8 (0.63 to 0.95)	13.3%[b]	10.2% (8.4 to 12.6)	3.1% less teeth (0.7 to 4.9 less) NNT 33	⊕⊕◯◯ low[d] due to bias	May have little to no difference in WSL development on teeth
		No varnish	F-varnish			
WSL development (pat.-level) Follow-up not reported 456 pats (2 wpRCTs)	RR 0.5 (0.18 to 1.15)	59.2%[b]	27.2% (10.7 to 68.1)	32.0% less patients (48.5 less to 8.9 more) NNT of -	⊕◯◯◯ very low[f,g] due to bias, inconsistency, imprecision	Probably little or no difference in the number of patients with WSL
WSL index (tth.-level) 6.0 months 1160 tth (2 wpRCTs)	-	2.7 points	-	0.3 points less severe (0.21 to 0.44 less)	⊕⊕◯◯ low[d] due to bias	Varnish may decrease WSL index (severity) on the teeth

Interventions for the prevention of WSLs during orthodontic treatment.
Population & intervention: adolescent or adult patients receiving fixed appliance orthodontic treatment.
Settings: university clinics, private practices, clinics, and hospitals (Belgium, Brazil, Great Britain, India, Italy, Sweden, Syria, USA).

[a] The basis for the risk in the control group (e.g., the median control group risk across studies) is provided in footnotes. The risk in the intervention group (and its 95% confidence interval) is based on the assumed risk in the comparison group and the relative effect of the intervention (and its 95% CI).
[b] Response in the control group is based on average event rate of included studies in each case.
[c] Starts from "high", due to the inclusion of randomized studies.
[d] Downgraded by two points due to serious limitations (high risk of bias).
[e] Downgraded by one point for imprecision; wide confidence intervals existing and the summary effect spans from large protective to negligible detrimental role for glass-ionomer adhesives.
[f] Downgraded by one point for bias; one of the two studies was in high risk of bias.
[g] Downgraded by one point for inconsistency (I^2>75%) and one point for imprecision (summary effect spans from very large protective to negligible detrimental role for varnish).

CI, confidence interval; F, fluoride; GRADE, Grading of Recommendations Assessment, Development and Evaluation; MD, mean difference; mo, month; NNT, number needed to treat; NR, not reported; Pat, patient; pRCT, parallel randomized clinical trial; RR, relative risk; Tth, tooth; wpRCTs, within-persons randomized clinical trial; WSL, white spot lesion.

FIGURE 1 PRISMA flowdiagram for study identification and selection.

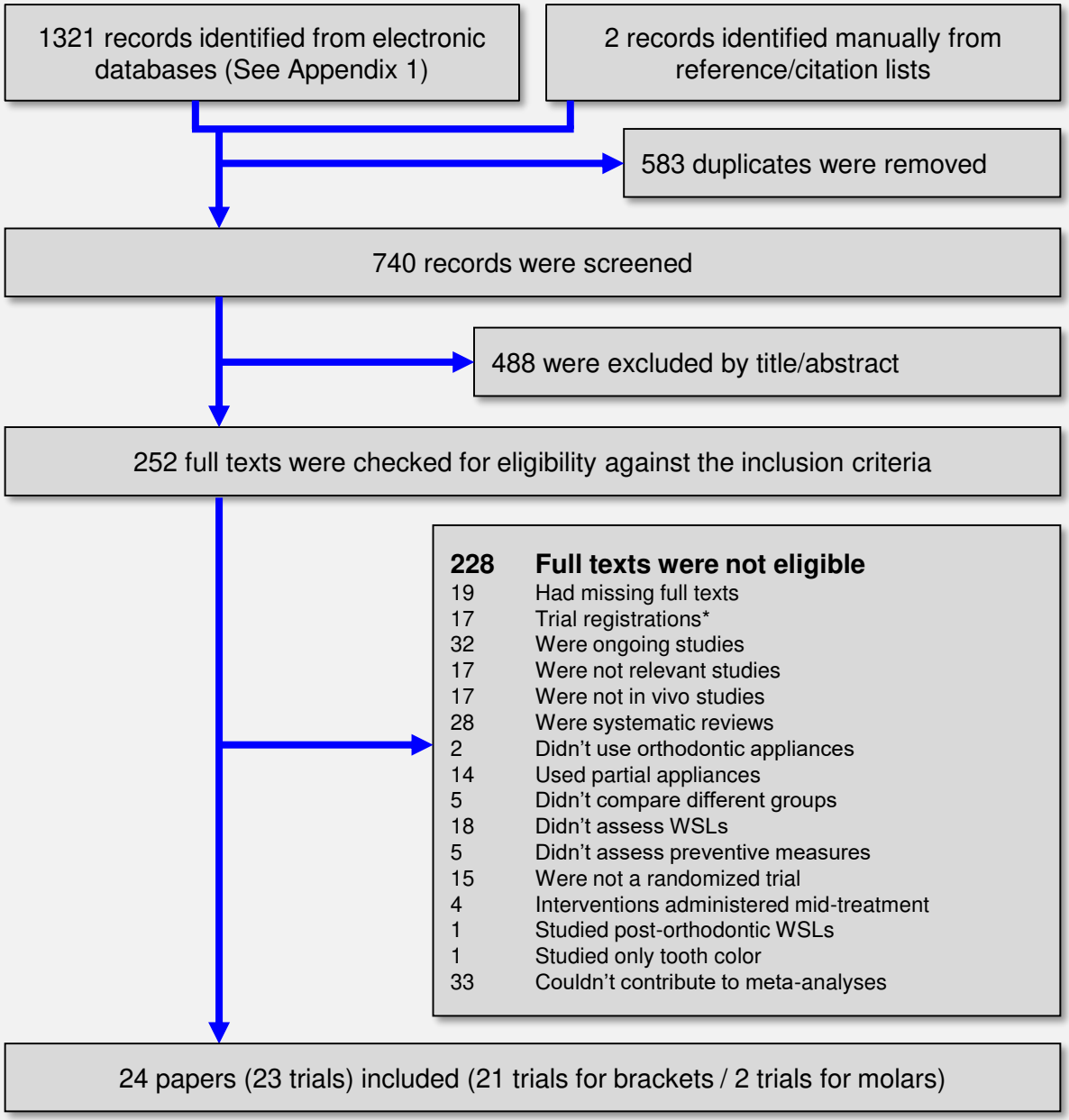


FIGURE 2 Risk of bias summary for the included randomized trials.

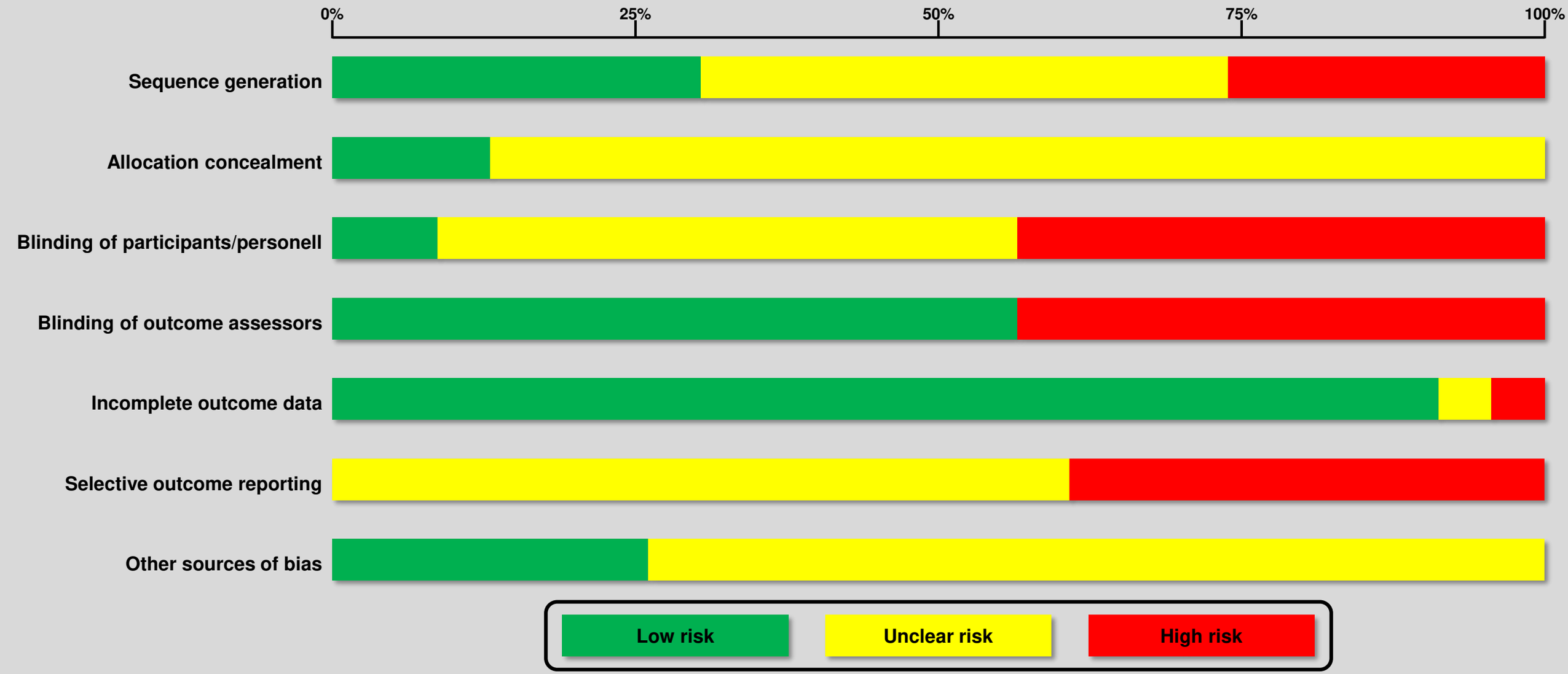
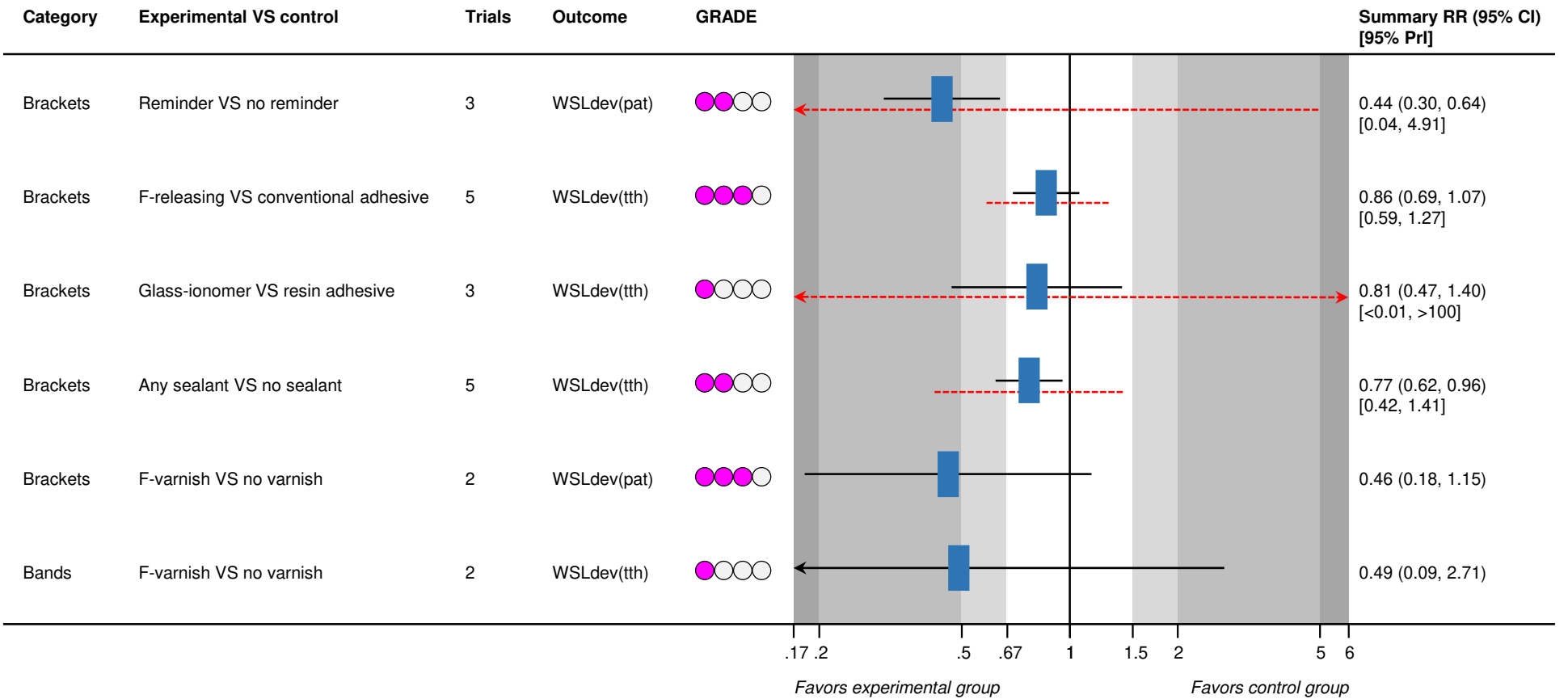


FIGURE 3 Contour-enhanced forest plot summary of all performed random-effects meta-analyses (REML method). CI, confidence interval; F, fluoride; GRADE, Grades of Recommendations, Assessment, Development, and Evaluation; pat, patient-level; PrI, predictive interval; RR, relative risk; tth, tooth-level; VS, versus; WSLdev, white spot lesion development.



Supplementary Material: Additional information on methods used and deviations from protocol.

Funding

No funding received for the present project.

Conflicts of interests

None declared.

Acknowledgements

None.

Additional methods

- Data reported as medians + interquartile ranges were planned to be converted to means + standard deviation according to guidelines from the Cochrane Handbook (Chapter 7.7.3.5). We assumed that the median was a good approximation of the mean. We calculated the standard deviation by dividing the provided interquartile range with 1.35.
- Data provided only in graphs was extracted with WebPlotDigitizer (https://automeris.io/WebPlotDigitizer/).

Deviations from protocol

- No conversions from medians + interquartile ranges to means + standard deviations were done, as no such data were included in any meta-analyses ultimately performed.
- Initially, the RoB 2.0 tool was planned in the review protocol to be used for the assessment of included randomized trials. Even though the definite paper including full guidance on the tool's use had not yet been published during protocol writing, it was expected that it would have been published at the time of risk of bias assessment. However, detailed guidance was still not available at assessment time and therefore the original RoB tool was used to assess included randomized trials.

- It had been initially planned that the Paule-Mandel variance estimator would be used for the random-effect model instead of the DerSimonian-Laird one, according to appropriate guidance at the time of protocol writing. However, more recent guidance (from the same group of the first guidance) subsequently suggested a REML approach as a more appropriate and therefore this was ultimately chosen.
- Several factors were planned to be assessed through subgroup analyses/meta-regressions in meta-analyses of at least 5 studies, but could ultimately not be conducted due to limited material/reporting: (i) subsets according to the patient sample characteristics (age, sex, malocclusion type, malocclusion severity, skeletal configuration), (ii) subsets according to the orthodontic appliance used (lingual or buccal/ brackets or bands/ conventional vs self-ligating brackets / ceramic or metal / ligated with elastics or steel ligatures), (iii) subsets according to the duration of the orthodontic treatment, (iv) subsets according to the level of oral hygiene of the patient at the time of seeking orthodontic treatment, (v) subsets according to the patients' compliance with treatment instructions.

Table S1. Literature search performed in each database with its search strategy (last search date: September 20th, 2018)

Nr	Database	Search	Limits	Hits
1	MEDLINE (via Pubmed)	orthodon* AND (deminerali* OR decalcifi* OR "white spot" OR "white-spot") AND (randomized controlled trial[pt] OR controlled clinical trial[pt] OR randomized[tiab] OR placebo[tiab] OR clinical trials as topic[mesh:noexp] OR randomly[tiab] OR trial[ti] NOT (animals[mh] NOT humans [mh]))	-	323
2	Embase	orthodon* AND (deminerali* OR decalcifi* OR 'white spot' OR 'white-spot') AND ('crossover procedure':de OR 'double-blind procedure':de OR 'randomized controlled trial':de OR 'single-blind procedure':de OR random*:de,ab,ti OR factorial*:de,ab,ti OR crossover*:de,ab,ti OR ((cross NEXT/1 over*):de,ab,ti) OR placebo*:de,ab,ti OR ((doubl* NEAR/1 blind*):de,ab,ti) OR ((singl* NEAR/1 blind*):de,ab,ti) OR assign*:de,ab,ti OR allocat*:de,ab,ti OR volunteer*:de,ab,ti) AND [embase]/lim	-	36
3	CDSR	orthodon* AND (deminerali* OR decalcifi* OR "white spot" OR "white-spot")	-	38
4	DARE	Same as CDSR	-	0
5	CENTRAL	Same as CDSR	-	271
6	Web of Knowledge	#1: TS= clinical trial* OR TS=research design OR TS=comparative stud* OR TS=evaluation stud* OR TS=controlled trial* OR TS=follow-up stud* OR TS=prospective stud* OR TS=random* OR TS=placebo* OR TS=(single blind*) OR TS=(double blind*)	DENTISTRY ORAL SURGERY MEDICINE	313
		#2: orthodon* AND (deminerali* OR decalcifi* OR "white spot" OR "white-spot")		
		#1 AND #2		
7	Scopus	#1: (INDEXTERMS ("clinical trials" OR "clinical trials as a topic" OR "randomized controlled trial" OR "Randomized Controlled Trials as Topic" OR "controlled clinical trial" OR "Controlled Clinical Trials" OR "random allocation" OR "Double-Blind Method" OR "Single-Blind Method" OR "Cross-Over Studies" OR "Placebos" OR "multicenter study" OR "double blind procedure" OR "single blind procedure" OR "crossover procedure" OR "clinical trial" OR "controlled study" OR "randomization" OR "placebo")) OR (TITLE-ABS-KEY (("clinical trials" OR "clinical trials as a topic" OR "randomized controlled trial" OR "Randomized Controlled Trials as Topic" OR "controlled clinical trial" OR "Controlled Clinical Trials as Topic" OR "random allocation" OR "randomly allocated" OR "allocated randomly" OR "Double-Blind Method" OR "Single-Blind Method" OR "Cross-Over Studies" OR "Placebos" OR "cross-over trial" OR "single blind" OR "double blind" OR "factorial design" OR "factorial trial"))) OR (TITLE-ABS (clinical trial* OR trial* OR rct* OR random* OR blind*))	Dentistry	285
		#2: orthodon* AND (deminerali* OR decalcifi* OR "white spot" OR "white-spot")		
		#1 AND #2		
8	Virtual Health Library*	orthodon* AND (deminerali* OR decalcifi* OR "white spot" OR "white-spot") AND random*	-	33
9	ClinicalTrials.gov	"orthodontic AND ""white spot"" orthodontic AND ""white-spot"" orthodontic AND ""demineralization"" orthodontic AND ""demineralisation"""	-	22
SUM				1321

CDSR, Cochrane Database of Systematic Reviews; CENTRAL, Cochrane Central Register of Controlled Trials; DARE, Cochrane Database of Abstracts of Reviews of Effects.

* covering among others the following databases: LILACS, Bibliografia Brasileira de Odontologia, BINACIS, WHO IRIS, IBECS, CUMED, PAHO, LIS -Health Information Locator, MedCarib, BDENF, Coleciona SUS, DeCS, PAHO-IRIS, Sec. Est. Saúde SP, HISA History of health, and Sec. Munic. Saúde SP.

Table S2. List of studies identified from the literature and their inclusion/exclusion status with reason.

Nr.	Paper	Status
1	Abbate GM, Caria MP, Montanari P, Mannu C, Orru G, Caprioglio A, et al. Periodontal health in teenagers treated with removable aligners and fixed orthodontic appliances. J Orofac Orthop 2015;76(3):240-50.	Excluded by title
2	Aglarci C, Demir N, Aksakalli S, Dilber E, Sozer OA, Kilic HS. Bond strengths of brackets bonded to enamel surfaces conditioned with femtosecond and Er:YAG laser systems. Lasers Med Sci. 2016;31(6):1177-83.	Excluded by title
3	Alcantara PC, Alexandria AK, Souza IP, Maia LC. In situ effect of titanium tetrafluoride and sodium fluoride on artificially decayed human enamel. Braz Dent J. 2014;25(1):28-32.	Excluded by title
4	Alessandri Bonetti G, Pazzi E, Zanarini M, Marchionni S, Checchi L. The effect of zinc-carbonate hydroxyapatite versus fluoride on enamel surfaces after interproximal reduction. Scanning. 2014;36(3):356-61.	Excluded by title
5	Aljehani A, Yousif MA, Angmar-Mansson B, Shi XQ. Longitudinal quantification of incipient carious lesions in postorthodontic patients using a fluorescence method. Eur J Oral Sci. 2006;114(5):430-4.	Excluded by title
6	Al-Khateeb S, Exterkate RA, de Josselin de Jong E, Angmar-Mansson B, ten Cate JM. Light-induced fluorescence studies on dehydration of incipient enamel lesions. Caries Res. 2002;36(1):25-30.	Excluded by title
7	Al-Twaijri S, Viana G, Bedran-Russo AK. Effect of prophylactic pastes containing active ingredients on the enamel-bracket bond strength of etch-and-rinse and self-etching systems. Angle Orthodontist. 2011;81(5):788-93.	Excluded by title
8	Andrucioli MC, Faria G, Nelson-Filho P, Romano FL, Matsumoto MA. Influence of resin-modified glass ionomer and topical fluoride on levels of Streptococcus mutans in saliva and biofilm adjacent to metallic brackets. J Appl Oral Sci. 2017;25(2):196-202.	Excluded by title
9	Arnold S, Koletsi D, Patcas R, Eliades T. The effect of bracket ligation on the periodontal status of adolescents undergoing orthodontic treatment. A systematic review and meta-analysis. Journal of Dentistry. 2016;54:13-24.	Excluded by title
10	Azevedo LM. Efeito da contaminação salivar na resistência de união da interface dentina/resina composta, tratada com clorexidina 0,2%. 2015:120-.	Excluded by title
11	Baeshen HA, Lingstrom P, Birkhed D. Effect of fluoridated chewing sticks (Miswaks) on white spot lesions in postorthodontic patients. Am J Orthod Dentofacial Orthop. 2011;140(3):291-7.	Excluded by title
12	Baka ZM, Akin M, Ileri Z, Basciftci FA. Effects of remineralization procedures on shear bond strengths of brackets bonded to demineralized enamel surfaces with self-etch systems. Angle Orthodontist. 2016;86(4):661-7.	Excluded by title
13	Bare-Welchel B, Campbell PM, Gonzalez M, Buschang PH. Effects of bone grafting, performed with corticotomies and buccal tooth movements, on dehiscence formation in dogs. Am J Orthod Dentofacial Orthop 2017;151(6):1034-47.	Excluded by title
14	Bartels AA, Evans CA, Viana G, Bedran-Russo AK. Demineralization of resin-sealed enamel by soft drinks in a clinically relevant pH cycling model. American Journal of Dentistry. 2016;29(2):115-9.	Excluded by title
15	Basiri T, Johnson ND, Moffa EB, Mulyar Y, Serra Nunes PL, Machado M, et al. Duplicated or Hybridized Peptide Functional Domains Promote Oral Homeostasis. J Dent Res. 2017;96(10):1162-7.	Excluded by title
16	Baysal A, Uysal T. Do enamel microabrasion and casein phosphopeptide-amorphous calcium phosphate affect shear bond strength of orthodontic brackets bonded to a demineralized enamel surface? Angle Orthod. 2012;82(1):36-41.	Excluded by title
17	Beerens MW, van der Veen MH, van Beek H, ten Cate JM. Effects of casein phosphopeptide amorphous calcium fluoride phosphate paste on white spot lesions and dental plaque after orthodontic treatment: a 3-month follow-up. Eur J Oral Sci. 2010;118(6):610-7.	Excluded by title
18	Behnan SM, Arruda AO, Gonzalez-Cabezas C, Sohn W, Peters MC. In-vitro evaluation of various treatments to prevent demineralization next to orthodontic brackets. Am J Orthod Dentofacial Orthop. 2010;138(6):712.e1-7; discussion -3.	Excluded by title
19	Blocher S, Frankenberger R, Hellak A, Schauseil M, Roggendorf MJ, Korbmacher-Steiner HM. Effect on enamel shear bond strength of adding microsilver and nanosilver particles to the primer of an orthodontic adhesive. Bmc Oral Health. 2015;15.	Excluded by title
20	Bock NC, Seibold L, Heumann C, Gnandt E, Roder M, Ruf S. Changes in white spot lesions following post-orthodontic weekly application of 1.25 per cent fluoride gel over 6 months-a randomized placebo-controlled clinical trial. Part I: photographic data evaluation. Eur J Orthod. 2017;39(2):134-43.	Excluded by title
21	Bock NC, Seibold L, Heumann C, Gnandt E, Roder M, Ruf S. Changes in white spot lesions following post-orthodontic weekly application of 1.25 per cent fluoride gel over 6 months-a randomized placebo-controlled clinical trial. Part II: clinical data evaluation. Eur J Orthod. 2017;39(2):144-52.	Excluded by title
22	Borges AB, Caneppele TMF, Masterson D, Maia LC. Is resin infiltration an effective esthetic treatment for enamel development defects and white spot lesions? A systematic review. Journal of Dentistry. 2017;56:11-8.	Excluded by title
23	Brochner A, Christensen C, Kristensen B, Tranaeus S, Karlsson L, Sonnesen L, et al. Treatment of post-orthodontic white spot lesions with casein phosphopeptide-stabilised amorphous calcium phosphate. Clin Oral Investig. 2011;15(3):369-73.	Excluded by title
24	Cacciafesta V, Sfondrini MF, Klersy C, Sfondrini G. Polymerization with a micro-xenon light of a resin-modified glass ionomer: a shear bond strength study 15 minutes after bonding. Eur J Orthod 2002;24(6):689-97.	Excluded by title
25	Cardoso PE, Meloncini MA, Placido E, Lima Jde O, Tavares AU. Influence of the substrate and load application method on the shear bond strength of two adhesive systems. Oper Dent. 2003;28(4):388-94.	Excluded by title
26	Castellan CS, Luiz AC, Bezinelli LM, Lopes RMG, Mendes FM, Eduardo CDP, et al. In vitro evaluation of enamel demineralization after Er:YAG and Nd:YAG laser irradiation on primary teeth. Photomedicine and Laser Surgery. 2007;25(2):85-90.	Excluded by title
27	Chau C, Campbell PM, Deljavan N, Taylor RW, Buschang PH. Retention of sealants during orthodontic treatment: An in vitro comparison of two etching protocols. Angle Orthodontist. 2015;85(5):750-6.	Excluded by title
28	Cheng HY, Chen CH, Li CA, Tsai HH, Chou TH, Wang WN. Bond strength of orthodontic light-cured resin-modified glass ionomer cement. Eur J Orthod 2011;33(2):180-4.	Excluded by title
29	Chimello DT, Serra MC, Rodrigues-Junior AL, Pecora JD, Corona SA. Influence of Er:YAG laser on microhardness of enamel adjacent to restorations submitted to cariogenic challenge in situ. Photomed Laser Surg. 2008;26(4):379-85.	Excluded by title
30	Danaei SM, Safavi A, Roeinpeikar SM, Oshagh M, Iranpour S, Omidkhoda M. Ion release from orthodontic brackets in 3 mouthwashes: an in-vitro study. Am J Orthod Dentofacial Orthop. 2011;139(6):730-4.	Excluded by title
31	Davies KR, Schneider GB, Southard TE, Hillis SL, Wertz PW, Finkelstein M, et al. Deciduous canine and permanent lateral incisor differential root resorption. Am J Orthod Dentofacial Orthop. 2001;120(4):339-47.	Excluded by title
32	Dilber E, Akin M, Yavuz T, Erdem A. Effects of Different Demineralization-Inhibiting Methods on the Shear Bond Strength of Glass-Ceramics. J Prosthodont. 2015;24(5):407-13.	Excluded by title
33	Do Amaral IPG, Ataíde Feitosa M, Azevedo Bispo ME, Montes MAJR. Influencia del tiempo de almacenamiento en la resistencia de unión a la dentina desproteinizada: utilizando tres diferentes adhesivos dentales. Acta Odontol Venez. 2011;49(4).	Excluded by title
34	Du M, Cheng N, Tai B, Jiang H, Li J, Bian Z. Randomized controlled trial on fluoride varnish application for treatment of white spot lesion after fixed orthodontic treatment. Clin Oral Investig. 2012;16(2):463-8.	Excluded by title
35	Eckstein A, Helms HJ, Knosel M. Camouflage effects following resin infiltration of postorthodontic white-spot lesions in vivo: One-year follow-up. Angle Orthod. 2015;85(3):374-80.	Excluded by title
36	El-Angbawi A, McIntyre GT, Fleming PS, Bearn DR. Non-surgical adjunctive interventions for accelerating tooth movement in patients undergoing fixed orthodontic treatment. Cochrane Database Syst Rev. 2015(11):Cd010887.	Excluded by title
37	Epasinghe DJ, Kwan S, Chu D, Lei MM, Burrow MF, Yiu CKY. Synergistic effects of proanthocyanidin, tri-calcium phosphate and fluoride on artificial root caries and dentine collagen. Mater Sci Eng C Mater Biol Appl. 2017;73:293-9.	Excluded by title
38	Epasinghe DJ, Yiu C, Burrow MF. Effect of flavonoids on remineralization of artificial root caries. Aust Dent J. 2016;61(2):196-202.	Excluded by title
39	Farhadian N, Usefi Mashoof R, Khanizadeh S, Ghaderi E, Farhadian M, Miresmaeili A. Streptococcus mutans counts in patients wearing removable retainers with silver nanoparticles vs those wearing conventional retainers: A randomized clinical trial. Am J Orthod Dentofacial Orthop. 2016;149(2):155-60.	Excluded by title
40	Fleming PS. Limited evidence suggests no difference in orthodontic attachment failure rates with the acid-etch technique and self-etch primers. Evid Based Dent. 2014;15(2):48-9.	Excluded by title
41	Foley T, Aggarwal M, Hatibovic-Kofman S. A comparison of in vitro enamel demineralization potential of 3 orthodontic cements. Am J Orthod Dentofacial Orthop. 2002;121(5):526-30.	Excluded by title
42	Fukino Y, Komori A. Time-related bond strength of resin-reinforced glass ionomer cement under various light exposure conditions. Orthodontic Waves. 2015;74(3):76-82.	Excluded by title
43	Gomez S, Uribe S, Onetto JE, Emilson CG. SEM analysis of sealant penetration in posterior approximal enamel carious lesions in vivo. J Adhes Dent. 2008;10(2):151-6.	Excluded by title
44	Goracci C, Gheewalla R, Kugel G, Ferrari M. Orthodontic-restorative treatment of chipped or worn incisors. Am J Dent. 2001;14(1):50-5.	Excluded by title
45	Guimarães LA, Almeida JCF, Wang L, Garcia FCP, Alpino PHP. Effectiveness of immediate bonding of etch-and-rinse adhesives to simplified ethanol-saturated dentin. Braz oral res. 2012;26(2):177-82.	Excluded by title
46	Hammad SM, Enan ET. In vivo effects of two acidic soft drinks on shear bond strength of metal orthodontic brackets with and without resin infiltration treatment. Angle Orthodontist. 2013;83(4):648-52.	Excluded by title
47	Harhash A, Salem G. Radiographic evaluation of non-operative repair depths for various preventive approaches. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2017;8(3):290-9.	Excluded by title
48	Harris AMP, Joseph VP, Rossouw PE. Shear Peel Bond Strengths of Aesthetic Orthodontic Brackets. Am J Orthod Dentofacial Orthop 1992;102(3):215-9.	Excluded by title
49	He T, Li X, Dong Y, Zhang N, Zhong Y, Yin W, et al. Comparative assessment of fluoride varnish and fluoride film for remineralization of postorthodontic white spot lesions in adolescents and adults over a 6-month period: A single-center, randomized controlled clinical trial. Am J Orthod Dentofacial Orthop. 2016;149(6):810-9.	Excluded by title
50	Hegarty DJ, Macfarlane TV. In vivo bracket retention comparison of a resin-modified glass ionomer cement and a resin-based bracket adhesive system after a year. Am J Orthod Dentofacial Orthop. 2002;121(5):496-501.	Excluded by title
51	Hellak AF, Riepe EM, Seubert A, Korbmacher-Steiner HM. Enamel demineralization after different methods of interproximal polishing. Clin Oral Investig. 2015;19(8):1965-72.	Excluded by title
52	Hu W, Featherstone JD. Prevention of enamel demineralization: an in-vitro study using light-cured filled sealant. Am J Orthod Dentofacial Orthop. 2005;128(5):592-600; quiz 70.	Excluded by title
53	Huang GJ, Roloff-Chiang B, Mills BE, Shalchi S, Spiekerman C, Korpak AM, et al. Effectiveness of MI Paste Plus and PreviDent fluoride varnish for treatment of white spot lesions: a randomized controlled trial. Am J Orthod Dentofacial Orthop. 2013;143(1):31-41.	Excluded by title
54	Jacques P, Hebling J. Effect of dentin conditioners on the microtensile bond strength of a conventional and a self-etching primer adhesive system. Dent Mater. 2005;21(2):103-9.	Excluded by title
55	Jain D, Sawhney A, Gupta B, Sharma S, Juneja S, Juneja M, et al. Clinical and radiologic evaluation of regenerative potential of nha paste and dbm in the treatment of periodontal intra-bony defects -A randomized control trial. Journal of Clinical and Diagnostic Research. 2016;10(9):ZC74-ZC9.	Excluded by title
56	Jayarajan J, Janardhanam P, Jayakumar P. Efficacy of CPP-ACP and CPP-ACPF on enamel remineralization - an in vitro study using scanning electron microscope and DIAGNOdent. Indian J Dent Res. 2011;22(1):77-82.	Excluded by title
57	Jordao MC, Alencar CR, Mesquita IM, Buzalaf MA, Magalhaes AC, Machado MA, et al. In situ Effect of Chewing Gum with and without CPP-ACP on Enamel Surface Hardness Subsequent to ex vivo Acid Challenge. Caries Res. 2016;50(3):325-30.	Excluded by title
58	Jung GB, Kim KA, Han I, Park YG, Park HK. Biochemical characterization of human gingival crevicular fluid during orthodontic tooth movement using Raman spectroscopy. 2014;5(10):3508-20.	Excluded by title
59	Kalha AS. Lack of reliable evidence of the effectiveness of remineralising agents for the treatment of post orthodontic white spot lesions. Evid Based Dent. 2013;14(3):76-7.	Excluded by title

60	Kanthathas K, Willmot DR, Benson PE. Differentiation of developmental and post-orthodontic white lesions using image analysis. Eur J Orthod. 2005;27(2):167-72.	Excluded by title
61	Kao RT, Nares S, Reynolds MA. Periodontal regeneration - intrabony defects: a systematic review from the AAP Regeneration Workshop. J Periodontol. 2015;86(2 Suppl):S77-104.	Excluded by title
62	Kecik D, Cehreli SB, Sar C, Unver B. Effect of acidulated phosphate fluoride and casein phosphopeptide-amorphous calcium phosphate application on shear bond strength of orthodontic brackets. Angle Orthodontist. 2008;78(1):129-33.	Excluded by title
63	Kim S, Katchooi M, Bayiri B, Sarikaya M, Korpak AM, Huang GJ. Predicting improvement of postorthodontic white spot lesions. Am J Orthod Dentofacial Orthop 2016;149(5):625-33.	Excluded by title
64	Kitsahawong K, Pitiphat W, Rattanacharoenthum A, Pungchanchaikul P, Seminario AL. Chemomechanical versus drilling methods for caries removal: an in vitro study. Braz oral res (Online). 2015;29(1):1-8.	Excluded by title
65	Knosel M, Attin R, Becker K, Attin T. External bleaching effect on the color and luminosity of inactive white-spot lesions after fixed orthodontic appliances. Angle Orthod. 2007;77(4):646-52.	Excluded by title
66	Knosel M, Eckstein A, Helms HJ. Durability of esthetic improvement following Icon resin infiltration of multibracket-induced white spot lesions compared with no therapy over 6 months: a single-center, split-mouth, randomized clinical trial. Am J Orthod Dentofacial Orthop. 2013;144(1):86-96.	Excluded by title
67	Kocadereli I, Ciger S. Retention of orthodontic bands with three different cements. J Clin Pediatr Dent. 1995;19(2):127-30.	Excluded by title
68	Korbmacher H, Huck L, Adam T, Kahl-Nieke B. Evaluation of an antimicrobial and fluoride-releasing self-etching primer on the shear bond strength of orthodontic brackets. Eur J Orthod 2006;28(5):457-61.	Excluded by title
69	Korbmacher HM, Huck L, Kahl-Nieke B. Fluoride-releasing adhesive and antimicrobial self-etching primer effects on shear bond strength of orthodontic brackets. Angle Orthodontist. 2006;76(5):845-50.	Excluded by title
70	Lee W, Karapetyan G, Moats R, Yamashita DD, Moon HB, Ferguson DJ, et al. Corticotomy-/osteotomy-assisted tooth movement microCTs differ. J Dent Res. 2008;87(9):861-7.	Excluded by title
71	Lovelace TB, Mellonig JT, Meffert RM, Jones AA, Nummikoski PV, Cochran DL. Clinical Evaluation of Bioactive Glass in the Treatment of Periodontal Osseous Defects in Humans. Journal of Periodontology. 1998;69(9):1027-35.	Excluded by title
72	Machado CM, Zamuner AC, Wang L, Ishikiriama SK, Modena KCdS. How erosive drinks and enzyme inhibitors impact bond strength to dentin. Braz oral res (Online). 2015;29(1):1-7.	Excluded by title
73	Majithia U, Venkataraghavan K, Choudhary P, Trivedi K, Shah S, Virda M. Comparative evaluation of application of different fluoride varnishes on artificial early enamel lesion: An in vitro study. Indian J Dent Res. 2016;27(5):521-7.	Excluded by title
74	Marquezan M, Osorio R, Ciamponi AL, Toledano M. Resistance to degradation of bonded restorations to simulated caries-affected primary dentin. Am J Dent. 2010;23(1):47-52.	Excluded by title
75	Martinhon CC, Italiani Fde M, Padilha Pde M, Bijella MF, Delbem AC, Buzalaf MA. Effect of iron on bovine enamel and on the composition of the dental biofilm formed "in situ". Arch Oral Biol. 2006;51(6):471-5.	Excluded by title
76	Mendonça FL. Remineralização e desmineralização erosiva do esmalte considerando diferentes tempos de ação salivar e dispositivos intrabucais: estudo in situ</i&gt. 2015:133-.	Excluded by title
77	Meng CL, Li CH, Wang WN. Bond strength with APF applied after acid etching. Am J Orthod Dentofacial Orthop. 1998;114(5):510-3.	Excluded by title
78	Modesto A, Souza I, Cordeiro P, Silva L, Primo L, Vianna R. Fluoride uptake in situ after the use of dental floss with fluoride. J Clin Dent. 1997;8(5):142-4.	Excluded by title
79	Mohanty P, Padmanabhan S, Chitharanjan AB. An in vitro evaluation of remineralization potential of novamin® on artificial enamel sub-surface lesions around orthodontic brackets using energy dispersive x-ray analysis (EDX). Journal of Clinical and Diagnostic Research. 2014;8(11):ZC88-ZC91.	Excluded by title
80	Montasser MA, El-Wassefy NA, Taha M. In vitro study of the potential protection of sound enamel against demineralization. Prog Orthod. 2015;16:12.	Excluded by title
81	Moqadam AS, Arash V, Mirzaie M, Fereydooni M, Haghani H, Rahmani A. Effect of alveolar ridge preservation with PDFDBA on orthodontic tooth movement rate, formation of gingival invagination and root resorption: A randomized, controlled pilot study. Biomedical and Pharmacology Journal. 2016;9(3):1229-35.	Excluded by title
82	Murphy TC, Willmot DR, Rodd HD. Management of postorthodontic demineralized white lesions with microabrasion: a quantitative assessment. Am J Orthod Dentofacial Orthop. 2007;131(1):27-33.	Excluded by title
83	Nasab NK, Kajan ZD, Balalaie A. Effect of Topacal C-5 on enamel adjacent to orthodontic brackets. An in vitro study. Aust Orthod J. 2007;23(1):46-9.	Excluded by title
84	Newman RA, Newman GV, Sengupta A. In vitro bond strengths of resin modified glass ionomer cements and composite resin self-cure adhesives: introduction of an adhesive system with increased bond strength and inhibition of decalcification. Angle Orthod. 2001;71(4):312-7.	Excluded by title
85	Noel L, Rebellato J, Sheats RD. The effect of argon laser irradiation on demineralization resistance of human enamel adjacent to orthodontic brackets: an in vitro study. Angle Orthod. 2003;73(3):249-58.	Excluded by title
86	Norris DS, McInnes-Ledoux P, Schwaninger B, Weinberg R. Retention of orthodontic bands with new fluoride-releasing cements. Am J Orthod. 1986;89(3):206-11.	Excluded by title
87	Novaes TF, Matos R, Raggio DP, Imparato JC, Braga MM, Mendes FM. Influence of the discomfort reported by children on the performance of approximal caries detection methods. Caries Res. 2010;44(5):465-71.	Excluded by title
88	Ogihara S, Tarnow DP. Efficacy of forced eruption/enamel matrix derivative with freeze-dried bone allograft or with demineralized freeze-dried bone allograft in infrabony defects: A randomized trial. Quintessence Int. 2015;46(6):481-90.	Excluded by title
89	Ogihara S, Wang HL. Periodontal regeneration with or without limited orthodontics for the treatment of 2- or 3-wall infrabony defects. J Periodontol. 2010;81(12):1734-42.	Excluded by title
90	Oh EJ, Park SS, Jang MJ, Jeon YM, Kim JG. Experimental brush wear pattern and cariostatic effect of Biscover. Korean Journal of Orthodontics. 2008;38(3):214-22.	Excluded by title
91	Oliveira GMS, Ritter AV, Heymann HO, Swift E, Donovan T, Brock G, et al. Remineralization effect of CPP-ACP and fluoride for white spot lesions in vitro. Journal of Dentistry. 2014;42(12):1592-602.	Excluded by title
92	O'Neill J. No randomised trials of interventions to manage relapse of lower incisors after orthodontic treatment. Evid Based Dent. 2013;14(4):116-7.	Excluded by title
93	ÖZkan G, Kanli A, Ba, amp, Eren NM, Arslan U, et al. Validation of micro-computed tomography for occlusal caries detection: an in vitro study. Braz oral res (Online). 2015;29(1):1-7.	Excluded by title
94	Paris S, Schwendicke F, Keltsch J, Dorfer C, Meyer-Lueckel H. Masking of white spot lesions by resin infiltration in vitro. Journal of Dentistry. 2013;41:E28-E34.	Excluded by title
95	Park SY, Cha JY, Kim KN, Hwang CJ. The effect of casein phosphopeptide amorphous calcium phosphate on the in vitro shear bond strength of orthodontic brackets. Korean Journal of Orthodontics. 2013;43(1):23-8.	Excluded by title
96	Paschos E, Kurochkina N, Huth KC, Hansson CS, Rudzki-Janson I. Failure rate of brackets bonded with antimicrobial and fluoride-releasing, self-etching primer and the effect on prevention of enamel demineralization. Am J Orthod Dentofacial Orthop. 2009;135(5):613-20.	Excluded by title
97	Patil VH, Anegundi RT. An in vitro assessment of fluoride uptake by tooth enamel from four different fluoride dentifrices. Eur Arch Paediatr Dent. 2014;15(5):347-51.	Excluded by title
98	Pellegrini P, Sauerwein R, Finlayson T, McLeod J, Covell DA, Jr., Maier T, et al. Plaque retention by self-ligating vs elastomeric orthodontic brackets: quantitative comparison of oral bacteria and detection with adenosine triphosphate-driven bioluminescence. Am J Orthod Dentofacial Orthop. 2009;135(4):426.e1-9; discussion -7.	Excluded by title
99	Peng Y, Wu R, Qu W, Wu W, Chen J, Fang J, et al. Effect of visual method vs plaque disclosure in enhancing oral hygiene in adolescents and young adults: a single-blind randomized controlled trial. Am J Orthod Dentofacial Orthop. 2014;145(3):280-6.	Excluded by title
100	Perdigao J, Lam VQ, Burseth BG, Real C. Masking of Enamel Fluorosis Discolorations and Tooth Misalignment With a Combination of At-Home Whitening, Resin Infiltration, and Direct Composite Restorations. Operative Dentistry. 2017;42(4):347-56.	Excluded by title
101	Phan X, Akyalcin S, Wiltshire WA, Rody WJ. Effect of tooth bleaching on shear bond strength of a fluoride-releasing sealant. Angle Orthodontist. 2012;82(3):546-51.	Excluded by title
102	Phijaisanit P, Tyas MJ. Comparison of the shear bond strength of a so-called 'dual-cured glass-ionomer cement' and a conventional resin composite used in orthodontic bonding. Aust Orthod J. 1997;15(1):23-9.	Excluded by title
103	Prabhakar AR, Mahantesh T, Ahuja V. Comparison of retention and demineralization inhibition potential of adhesive banding cements in primary teeth. J Dent Child (Chic). 2010;77(2):66-71.	Excluded by title
104	Pratt KC, Hicks J, English JD, Bussa HI, Flaitz CM, Powers JM. Fluoride-releasing orthodontic adhesives and topical fluoride effect on enamel caries formation: An in vitro study. American Journal of Dentistry. 2010;23(3):179-84.	Excluded by title
105	Pretty IA, Pender N, Edgar WM, Higham SM. The in vitro detection of early enamel de- and re-mineralization adjacent to bonded orthodontic cleats using quantitative light-induced fluorescence. Eur J Orthod. 2003;25(3):217-23.	Excluded by title
106	Raggio DP, Sonego FG, Camargo LB, Marquezan M, Imparato JC. Efficiency of different polyacrylic acid concentrations on the smear layer, after ART technique, by Scanning Electron Microscopy (SEM). Eur Arch Paediatr Dent. 2010;11(5):232-5.	Excluded by title
107	Ramalingam A, Kailasam V, Padmanabhan S, Chitharanjan A. The effect of topical fluoride agents on the physical and mechanical properties of NiTi and copper NiTi archwires. An in vivo study. Australian Orthodontic Journal. 2008;24(1):26-31.	Excluded by title
108	Ramirez-Echave JI, Buschang PH, Carrillo R, Rossouw PE, Nagy WW, Opperman LA. Histologic evaluation of root response to intrusion in mandibular teeth in beagle dogs. Am J Orthod Dentofacial Orthop 2011;139(1):60-9.	Excluded by title
109	Rechmann P, Fried D, Le CQ, Nelson G, Rapozo-Hilo M, Rechmann BM, et al. Caries inhibition in vital teeth using 9.6-mum CO2-laser irradiation. J Biomed Opt. 2011;16(7):071405.	Excluded by title
110	Rex T, Kharbanda OP, Petocz P, Darendeliler MA. Physical properties of root cementum: part 6. A comparative quantitative analysis of the mineral composition of human premolar cementum after the application of orthodontic forces. Am J Orthod Dentofacial Orthop. 2006;129(3):358-67.	Excluded by title
111	Rodrigues JA, Marchi GM, Serra MC, Hara AT. Visual evaluation of in vitro cariostatic effect of restorative materials associated with dentifrices. Braz Dent J. 2005;16(2):112-8.	Excluded by title
112	Rubel M, Prashant GM, Naveen Kumar PG, Sushanth VH, Imranulla M, Potlia I, et al. Effect of grape seed extract on remineralization of artificial caries: An in-vitro study. Asian Journal of Pharmaceutical and Clinical Research. 2016;9(5):174-6.	Excluded by title
113	Salar DV, Garcia-Godoy F, Flaitz CM, Hicks MJ. Potential inhibition of demineralization in vitro by fluoride-releasing sealants. J Am Dent Assoc. 2007;138(4):502-6.	Excluded by title
114	Sales-Peres SH, Pessan JP, Buzalaf MA. Effect of an iron mouthrinse on enamel and dentine erosion subjected or not to abrasion: an in situ/ex vivo study. Arch Oral Biol. 2007;52(2):128-32.	Excluded by title
115	Sayinsu K, Isik F, Sezen S, Aydemir B. Effect of blood and saliva contamination on bond strength of brackets bonded with a protective liquid polish and a light-cured adhesive. Am J Orthod Dentofacial Orthop. 2007;131(3):391-4.	Excluded by title
116	Sayinsu K, Isik F, Sezen S, Aydemir B. New protective polish effects on shear bond strength of brackets. Angle Orthod. 2006;76(2):306-9.	Excluded by title
117	Schlueter N, Klimek J, Ganss C. Effect of a chitosan additive to a Sn2+-containing toothpaste on its anti-erosive/anti-abrasive efficacy--a controlled randomised in situ trial. Clin Oral Investig. 2014;18(1):107-15.	Excluded by title
118	Staley RN, Mack SJ, Wefel JS, Vargas MA, Jakobsen JR. Effect of brushing on fluoride release from 3 bracket adhesives. Am J Orthod Dentofacial Orthop 2004;126(3):331-6.	Excluded by title
119	Sudjalim TR, Woods MG, Manton DJ, Reynolds EC. Prevention of demineralization around orthodontic brackets in vitro. Am J Orthod Dentofacial Orthop. 2007;131(6):705.e1-9.	Excluded by title
120	Suebsureekul P, Viteporn S. Release of fluoride from orthodontic adhesives and penetration into enamel. J Orofac Orthop 2017;78(3):185-92.	Excluded by title
121	Tabrizi A, Cakirer B. A comparative evaluation of casein phosphopeptide-amorphous calcium phosphate and fluoride on the shear bond strength of orthodontic brackets. Eur J Orthod. 2011;33(3):282-7.	Excluded by title
122	Takeuti ML, Marquezan M, Rodrigues CR, Rodrigues Filho LE, Rocha Rde O. Inhibition of demineralization adjacent to tooth-colored restorations in primary teeth after 2 in vitro challenges. J Dent Child (Chic). 2007;74(3):209-14.	Excluded by title
123	Talbot TQ, Blankenau RJ, Zobitz ME, Weaver AL, Lohse CM, Rebellato J. Effect of argon laser irradiation on shear bond strength of orthodontic brackets: an in vitro study. Am J Orthod Dentofacial Orthop. 2000;118(3):274-9.	Excluded by title
124	Tanna N, Kao E, Gladwin M, Ngan PW. Effects of sealant and self-etching primer on enamel decalcification. Part I: an in-vitro study. Am J Orthod Dentofacial Orthop. 2009;135(2):199-205.	Excluded by title

125	Tay FR, Gwinnett AJ, Wei SH. Ultrastructure of the resin-dentin interface following reversible and irreversible rewetting. Am J Dent. 1997;10(2):77-82.	Excluded by title
126	Tay FR, Gwinnett JA, Wei SH. Micromorphological spectrum from overdrying to overwetting acid-conditioned dentin in water-free acetone-based, single-bottle primer/adhesives. Dent Mater. 1996;12(4):236-44.	Excluded by title
127	Tay FR, Gwinnett JA, Wei SH. The overwet phenomenon in two-component acetone-based primers containing aryl amine and carboxylic acid monomers. Dent Mater. 1997;13(2):118-27.	Excluded by title
128	Thaveesangpanich P, Itthagarun A, King NM, Wefel JS, Tay FR. In vitro model for evaluating the effect of child formula toothpastes on artificial caries in primary dentition enamel. Am J Dent. 2005;18(3):212-6.	Excluded by title
129	Trairatvorakul C, Techalertpaisarn P, Siwawut S, Ingprapankorn A. Effect of glass ionomer cement and fluoride varnish on the remineralization of artificial proximal caries in situ. J Clin Pediatr Dent. 2009;34(2):131-4.	Excluded by title
130	Ulkur F, Sungurtekin Ekci E, Nalbantgil D, Sandalli N. In vitro effects of two topical varnish materials and Er:YAG laser irradiation on enamel demineralization around orthodontic brackets. ScientificWorldJournal. 2014;2014:490503.	Excluded by title
131	Uysal T, Baysal A, Uysal B, Aydinbelge M, Al-Qunaian T. Do fluoride and casein phosphopeptide-amorphous calcium phosphate affect shear bond strength of orthodontic brackets bonded to a demineralized enamel surface? Angle Orthod. 2011;81(3):490-5.	Excluded by title
132	Uysal T, Ustdal A, Nur M, Catalbas B. Bond strength of ceramic brackets bonded to enamel with amorphous calcium phosphate-containing orthodontic composite. Eur J Orthod. 2010;32(3):281-4.	Excluded by title
133	Van Bebber L, Campbell PM, Honeyman AL, Spears R, Buschang PH. Does the amount of filler content in sealants used to prevent decalcification on smooth enamel surfaces really matter? Angle Orthod. 2011;81(1):134-40.	Excluded by title
134	Varlik SK, Ulusoy C. Effect of light-cured filled sealant on shear bond strength of metal and ceramic brackets bonded with a resin-modified glass ionomer cement. Am J Orthod Dentofacial Orthop 2009;135(2):194-8.	Excluded by title
135	Vel II, Akin M, Baka ZM, Uysal T. Effects of different pre-treatment methods on the shear bond strength of orthodontic brackets to demineralized enamel. Acta Odontol Scand. 2016;74(1):7-13.	Excluded by title
136	Wang CY, Jiang L, Lan J, Zhang J, Li W. [Application of atomic force microscopy in evaluation of three-dimensional morphology of eroded human enamel]. Zhonghua Kou Qiang Yi Xue Za Zhi. 2012;47(6):340-4.	Excluded by title
137	Wang L, Jian J, Lu HF. Efficiency of resin infiltration versus fluride varnish for treatment of post-orthodontic white spot lesions. Chinese Journal of Tissue Engineering Research. 2013;17(29):5303-8.	Excluded by title
138	Wang XY, Miyazaki K, Itoh Y, Motokawa W. Effect of experimental fluoride-releasing tooth separator on acid resistance of human enamel in vitro. Dent Mater J. 2001;20(4):275-85.	Excluded by title
139	Wang Y, Mei L, Gong L, Li J, He S, Ji Y, et al. Remineralization of early enamel caries lesions using different bioactive elements containing toothpastes: An in vitro study. Technol Health Care. 2016;24(5):701-11.	Excluded by title
140	Willmot D. A randomized trial of the treatment of postorthodontic enamel white spot lesions with mouth rinses. (BSPD Abstract). International journal of paediatric dentistry 2002;12(5).	Excluded by title
141	Wong VS, Freer TJ, Joseph BK, Daley TJ. Tooth movement and vascularity of the dental pulp: a pilot study. Aust Orthod J. 1999;15(4):246-50.	Excluded by title
142	Yang QL, Chen SJ, Wan Y, Geng C, Rong GY. Occlusion of dentinal tubules using tricalcium silicate. Chinese Journal of Tissue Engineering Research. 2013;17(38):6740-6.	Excluded by title
143	Yetkiner E, Wegehaupt F, Wiegand A, Attin R, Attin T. Colour improvement and stability of white spot lesions following infiltration, micro-abrasion, or fluoride treatments in vitro. Eur J Orthod 2014;36(5):595-602.	Excluded by title
144	Yetkiner E, Wegehaupt FJ, Attin R, Attin T. Caries infiltrant combined with conventional adhesives for sealing sound enamel in vitro. Angle Orthodontist. 2013;83(5):858-63.	Excluded by title
145	Yetkiner E, Wegehaupt FJ, Attin R, Wiegand A, Attin T. Stability of two resin combinations used as sealants against toothbrush abrasion and acid challenge in vitro. Acta Odontologica Scandinavica. 2014;72(8):825-30.	Excluded by title
146	Yu W, Ling G, Yan J, Lichun Z, Song C. [Effects of dentin demineralization and bond-strength properties of bioactive glass containing resin adhesive]. Hua Xi Kou Qiang Yi Xue Za Zhi. 2016;34(4):350-3.	Excluded by title
147	Yu Y, Sun J, Lai W, Wu T, Koshy S, Shi Z. Interventions for managing relapse of the lower front teeth after orthodontic treatment. Cochrane Database Syst Rev. 2013(9):Cd008734.	Excluded by title
148	Yuan H, Li JY, Chen L, Cheng L, Cannon RD, Mei L. Esthetic comparison of white-spot lesion treatment modalities using spectrometry and fluorescence. Angle Orthodontist. 2014;84(2):343-9.	Excluded by title
149	Zanarini M, Pazzi E, Bonetti S, Ruggeri O, Alessandri Bonetti G, Prati C. In vitro evaluation of the effects of a fluoride-releasing composite on enamel demineralization around brackets. Prog Orthod. 2012;13(1):10-6.	Excluded by title
150	Zhang Y, Chong Y, Huang RZ. [Effect of topical iron, fluoride application on eroded enamel in vitro]. Shanghai Kou Qiang Yi Xue. 2016;25(2):168-71.	Excluded by title
151	Abdullah Z, John J. Minimally Invasive Treatment of White Spot Lesions - A Systematic Review. Oral Health & Preventive Dentistry. 2016;14(3):197-205.	Excluded by title
152	Chen H, Liu X, Dai J, Jiang Z, Guo T, Ding Y. Effect of remineralizing agents on white spot lesions after orthodontic treatment: a systematic review. Am J Orthod Dentofacial Orthop. 2013;143(3):376-82.e3.	Excluded by title
153	Hochli D, Hersberger-Zurfluh M, Papageorgiou SN, Eliades T. Interventions for orthodontically induced white spot lesions: a systematic review and meta-analysis. Eur J Orthod. 2017;39(2):122-33.	Excluded by title
154	Aasrum E, Nganga PM, Dahm S, Ogaard B. Tensile Bond Strength of Orthodontic Brackets Bonded with a Fluoride-Releasing Light-Curing Adhesive - an in-Vitro Comparative-Study. Am J Orthod Dentofacial Orthop 1993;104(1):48-50.	Excluded by title
155	Abufarwa M, Noureldin A, Campbell PM, Buschang PH. Comparative study of two chemical protocols for creating white spot lesions: An in vitro FluoreCam evaluation. J Investig Clin Dent. 2018;9(1).	Excluded by title
156	Abufarwa M, Noureldin A, Campbell PM, Buschang PH. Reliability and validity of FluoreCam for white-spot lesion detection: An in vitro study. J Investig Clin Dent. 2018;9(1).	Excluded by title
157	Agarwal A, Pandey H, Pandey L, Choudhary G. Effect of fluoridated toothpaste on white spot lesions in postorthodontic patients. Int J Clin Pediatr Dent. 2013;6(2):85-8.	Excluded by title
158	Agnihotry A, Fedorowicz Z, Nasser M. Adhesively bonded versus non-bonded amalgam restorations for dental caries. Cochrane Database Syst Rev 2016(3).	Excluded by title
159	Ahovuo-Saloranta A, Forss H, Hiiri A, Nordblad A, Mäkelä M. Pit and fissure sealants versus fluoride varnishes for preventing dental decay in the permanent teeth of children and adolescents. Cochrane Database Syst Rev 2016(1).	Excluded by title
160	Ahrari F, Akbari M, Mohammadpour S, Forghani M. The efficacy of laser-assisted in-office bleaching and home bleaching on sound and demineralized enamel. Laser Ther. 2015;24(4):257-64.	Excluded by title
161	Akin M, Basciftci FA. Can white spot lesions be treated effectively? Angle orthodontist. 2012;82(5):770-5.	Excluded by title
162	Akkocaoglu M, Cehreli MC, Tekdemir I, Comert A, Güzel E, Dağdeviren A, et al. Primary Stability of Simultaneously Placed Dental Implants in Extraoral Donor Graft Sites: A Human Cadaver Study. Journal of Oral and Maxillofacial Surgery. 2007;65(3):400-7.	Excluded by title
163	Algera TJ, Kleverlaan CJ, de Gee AJ, Prahl-Andersen B, Feilzer AJ. The influence of accelerating the setting rate by ultrasound or heat on the bond strength of glass ionomers used as orthodontic bracket cements. Eur J Orthod 2005;27(5):472-6.	Excluded by title
164	Anderson DG, Chiego DJ, Glickman GN, McCauley LK. A clinical assessment of the effects of 10% carbamide peroxide gel on human pulp tissue. Journal of endodontics. 1999;25(4).	Excluded by title
165	Angriawan IP, Anggani HS, Ismah N. Color changes of post-debonding white spot lesion after microabrasion technique with fluoride and casein phosphopeptide-amorphous calcium phosphate application. Asian Journal of Pharmaceutical and Clinical Research. 2018;11(Special Issue 1):196-9.	Excluded by title
166	Aravind N, Pandiyan S. Demineralisation around orthodontic brackets- A review. Research Journal of Pharmacy and Technology. 2016;9(9):1536-40.	Excluded by title
167	Atieh MA, Alsabeeha NHM, Payne AGT, Duncan W, Faggion CM, Esposito M. Interventions for replacing missing teeth: alveolar ridge preservation techniques for dental implant site development. Cochrane Database Syst Rev 2015(5).	Excluded by title
168	Baeshen HA, Lingstrom P, Birkhed D. Effects of fluoridated chewing sticks (miswaks) on white spot lesions in post-orthodontic patients. Journal of orthodontics. 2012;39(3):228.	Excluded by title
169	Bakhsh TA, Bakry AS, Mandurah MM, Abbassy MA. Novel evaluation and treatment techniques for white spot lesions. An in vitro study. Orthodontics & Craniofacial Research. 2017;20(3):170-6.	Excluded by title
170	Beerens MW, Boekitwetan F, Van Der Veen MH, Ten Cate JM. White spot lesions after orthodontic treatment assessed by clinical photographs and by quantitative light-induced fluorescence imaging; a retrospective study. Acta Odontologica Scandinavica. 2015;73(6):441-6.	Excluded by title
171	Berglundh T, Abrahamsson I, Lang NP, Lindhe J. De novo alveolar bone formation adjacent to endosseous implants: A model study in the dog. Clinical Oral Implants Research. 2003;14(3):251-62.	Excluded by title
172	Bonafe-Oliveira L, Faltin RM, Arana-Chavez VE. Ultrastructural and histochemical examination of alveolar bone at the pressure areas of rat molars submitted to continuous orthodontic force. European Journal of Oral Sciences. 2003;111(5):410-6.	Excluded by title
173	Boteon AP, Kato MT, Buzalaf MAR, Prakki A, Wang L, Rios D, et al. Effect of Proanthocyanidin-enriched extracts on the inhibition of wear and degradation of dentin demineralized organic matrix. Arch Oral Biol. 2017;84:118-24.	Excluded by title
174	Boteon AP, Prakki A, Rabelo Buzalaf MA, Rios D, Honorio HM. Effect of different concentrations and application times of proanthocyanidin gels on dentin erosion. Am J Dent. 2017;30(2):96-100.	Excluded by title
175	Brisceno CE, Rossouw PE, Carrillo R, Spears R, Buschang PH. Healing of the roots and surrounding structures after intentional damage with miniscrew implants. Am J Orthod Dentofacial Orthop. 2009;135(3):292-301.	Excluded by title
176	Bueno MG, Marsicano JA, Sales-Peres SH. Preventive effect of iron gel with or without fluoride on bovine enamel erosion in vitro. Aust Dent J. 2010;55(2):177-80.	Excluded by title
177	Cain K, Hicks J, English J, Flaitz C, Powers JM, Rives T. In vitro enamel caries formation and orthodontic bonding agents. American Journal of Dentistry. 2006;19(3):187-92.	Excluded by title
178	Carvalho TS, Peters BG, Rios D, Magalhaes AC, Sampaio FC, Buzalaf MA, et al. Fluoride varnishes with calcium glycerophosphate: fluoride release and effect on in vitro enamel demineralization. Braz Oral Res. 2015;29.	Excluded by title
179	Chambers C, Stewart S, Su B, Sandy J, Ireland A. Prevention and treatment of demineralisation during fixed appliance therapy: a review of current methods and future applications. British Dental Journal. 2013;215(10):505-11.	Excluded by title
180	Chen Y, Lee JW, Cho WH, Kyung HM. Potential of self-drilling orthodontic microimplants under immediate loading. Am J Orthod Dentofacial Orthop 2010;137(4):496-502.	Excluded by title
181	Dashash M, Yeung CA, Jamous I, Blinkhorn A. Interventions for the restorative care of amelogenesis imperfecta in children and adolescents. Cochrane Database Syst Rev 2013(6).	Excluded by title
182	de Sousa HA, de Alencar AHG, Bruno KF, Batista AC, de Carvalho ACP. Microscopic evaluation of the effect of different storage media on the periodontal ligament of surgically extracted human teeth. Dental Traumatology. 2008;24(6):628-32.	Excluded by title
183	Dey S, Pandey V, Kumar A, Awasthi N, Sahu A, Pujari SC. In vitro Comparison of Impact of Different Bleaching Agents on the Microhardness of Enamel. J Contemp Dent Pract. 2016;17(3):258-62.	Excluded by title
184	Diedrich P, Fritz U, Kinzinger G, Angelakis J. Movement of periodontally affected teeth after guided tissue regeneration (GTR) - An experimental pilot study in animals. Journal of Orofacial Orthopedics. 2003;64(3):214-27.	Excluded by title
185	Do-Gyoon K, Kathy E, Yonghoon J, Hyun-Jung K, Matthew C, William B, et al. Differences between buccal and lingual bone quality of peri-implant regions. Journal of Orthopaedic Research. 2016;34.	Excluded by title
186	Dorri M, Dunne SM, Walsh T, Schwendicke F. Micro-invasive interventions for managing proximal dental decay in primary and permanent teeth. Cochrane Database Syst Rev 2015(11).	Excluded by title
187	Dorri M, Martinez-Zapata MJ, Walsh T, Marinho VCC, Sheiham A, Zaror C. Atraumatic restorative treatment versus conventional restorative treatment for managing dental caries. Cochrane Database Syst Rev 2017(12).	Excluded by title

188	Du MQ, Li Q, Jiang H, Tai B. Effect of Duraphat on enamel demineralization after fixed orthodontic treatment. 2nd meeting of IADR pan asian pacific federation (PAPF) and the 1st meeting of IADR asia/pacific region (APR); 2009, sep 22-24; wuhan, china. 2009:277.	Excluded by title
189	Dubroc GC, Jr., Mayo JA, Rankine CAN. Reduction of caries and of demineralization around orthodontic brackets: Effect of a fluoride-releasing resin in the rat model. Am J Orthod Dentofacial Orthop 1994;106(6):583-7.	Excluded by title
190	Duraisamy V, Xavier A, Nayak UA, Reddy V, Rao A. An in vitro evaluation of the demineralization inhibitory effect of F- varnish and casein phosphopeptide-amorphous calcium phosphate on enamel in young permanent teeth. Journal of Pharmacy and Bioallied Sciences. 2015;7(6):S513-S7.	Excluded by title
191	Ebadifar A, Nomani M, Fatemi SA. Effect of nano-hydroxyapatite toothpaste on microhardness ofartificial carious lesions created on extracted teeth. J Dent Res Dent Clin Dent Prospects. 2017;11(1):14-7.	Excluded by title
192	Ebrahimi M, Mehrabkhani M, Ahrari F, Parisay I, Jahantigh M. The effects of three remineralizing agents on regression of white spot lesions in children: A two-week, single-blind, randomized clinical trial. J Clin Exp Dent. 2017;9(5):e641-e8.	Excluded by title
193	El-Angbawi A, McIntyre GT, Fleming PS, Bearn DR. Non-surgical adjunctive interventions for accelerating tooth movement in patients undergoing fixed orthodontic treatment. Cochrane Database Syst Rev 2015(11).	Excluded by title
194	Epasinghe DJ, Yiu C, Burrow MF. Synergistic effect of proanthocyanidin and CPP-ACFP on remineralization of artificial root caries. Aust Dent J. 2015;60(4):463-70.	Excluded by title
195	Esposito M, Felice P, Worthington HV. Interventions for replacing missing teeth: augmentation procedures of the maxillary sinus. Cochrane Database Syst Rev 2014(5).	Excluded by title
196	Esposito M, Grusovin MG, Felice P, Karatzopoulos G, Worthington HV, Coulthard P. Interventions for replacing missing teeth: horizontal and vertical bone augmentation techniques for dental implant treatment. Cochrane Database Syst Rev 2009(4).	Excluded by title
197	Faltin RM, Faltin K, Sander FG, Arana-Chavez VE. Ultrastructure of cementum and periodontal ligament after continuous intrusion in humans: a transmission electron microscopy study. Eur J Orthod 2001;23(1):35-49.	Excluded by title
198	Featherstone JDB, Stookey GK, Kaminski MA, Faller RV. Recommendation for a non-animal alternative to rat caries testing. American Journal of Dentistry. 2011;24(5):289-94.	Excluded by title
199	Fernandez-Ferrer L, Vicente-Ruiz M, Garcia-Sanz V, Montiel-Company JM, Paredes-Gallardo V, Almerich-Silla JM, et al. Enamel remineralization therapies for treating postorthodontic white-spot lesions A systematic review. Journal of the American Dental Association. 2018;149(9):778-+.	Excluded by title
200	Freire JNO, Silva N, Gil JN, Magini RS, Coelho PG. Histomorphologic and histomophometric evaluation of immediately and early loaded mini-implants for orthodontic anchorage. Am J Orthod Dentofacial Orthop 2007;131(6).	Excluded by title
201	Furness S, Worthington HV, Bryan G, Birchenough S, McMillan R. Interventions for the management of dry mouth: topical therapies. Cochrane Database Syst Rev 2011(12).	Excluded by title
202	Gandhi G, Kalra JPS, Goyal A, Sharma A. Microphotographic Assessment of Enamel Surface using Self-Etching Primer and Conventional Phosphoric Acid: An In vitro Study. Contemp Clin Dent. 2018;9(1):15-9.	Excluded by title
203	Ghaffari H, Mirhashemi A, Baherimoghadam T, Azmi A, Rasooli R. Effect of Surface Treatment on Enamel Cracks After Orthodontic Bracket Debonding: Er,Cr:YSGG Laser-Etching Versus Acid-Etching. J Dent (Tehran). 2017;14(5):259-66.	Excluded by title
204	Ghanbarzadeh M, Ahrari F, Akbari M, Hamzei H. Microhardness of demineralized enamel following home bleaching and laser-assisted in office bleaching. J Clin Exp Dent. 2015;7(3):e405-9.	Excluded by title
205	Giardino L, Savoldi E, Pontieri F, Berutti E. Russell bodies in dental pulp of permanent human teeth. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology and Endodontology. 2004;98(6):760-4.	Excluded by title
206	Gillgrass TJ, Creanor SL, Foye RH, Millett DT. Varnish or polymeric coating for the prevention of demineralization? An ex vivo study. Journal of Orthodontics. 2001;28(4):291-5.	Excluded by title
207	Giulio AB, Matteo Z, Serena IP, Silvia M, Luigi C. In vitro evaluation of casein phosphopeptide-amorphous calcium phosphate (CPP-ACP) effect on stripped enamel surfaces. A SEM investigation. Journal of Dentistry. 2009;37(3):228-32.	Excluded by title
208	Gokce G, Savas S, Kucukyilmaz E, Veli I. Effects of toothpastes on white spot lesions around orthodontic brackets using quantitative light-induced fluorescence (QLF) : An in vitro study. J Orofac Orthop. 2017;78(6):480-6.	Excluded by title
209	Goncalves RS, Candia Scaffa PM, Giacomini MC, Rabelo Buzalaf MA, Honorio HM, Wang L. Use of sodium trimetaphosphate in the inhibition of dentin matrix metalloproteinases and as a remineralizing agent. J Dent. 2018;68:34-40.	Excluded by title
210	Gonzalez-Lopez S, de Medeiros CL, Defren CA, Bolanos-Carmona MV, Sanchez-Sanchez P, Menendez-Nunez M. Demineralization effects of hydrogen peroxide on bovine enamel and relation to shear bond strength of brackets. J Adhes Dent. 2009;11(6):461-7.	Excluded by title
211	Guo J, Li C, Zhang Q, Wu G, Deacon SA, Chen J, et al. Secondary bone grafting for alveolar cleft in children with cleft lip or cleft lip and palate. Cochrane Database Syst Rev 2011(6).	Excluded by title
212	Harris R, Gamboa A, Dailey Y, Ashcroft A. One-to-one dietary interventions undertaken in a dental setting to change dietary behaviour. Cochrane Database Syst Rev 2012(3).	Excluded by title
213	He T, Deng Y. [Microvasculature of the dog's periodontal ligament and its immediate response to orthodontic forces]. Hua Xi Kou Qiang Yi Xue Za Zhi. 1998;16(1):29-31, 55.	Excluded by title
214	Heravi F, Ahrari F, Tanbakuchi B. Effectiveness of MI Paste Plus and Remin Pro on remineralization and color improvement of postorthodontic white spot lesions. Dent Res J (Isfahan). 2018;15(2):95-103.	Excluded by title
215	Hicks J, Winn D, Flaitz C, Powell L. In vivo caries formation in enamel following argon laser irradiation and combined fluoride and argon laser treatment: A clinical pilot study. Quintessence International. 2004;35(1):15-20.	Excluded by title
216	Higham SM, Pretty IA, Edgar WM, Smith PW. The use of in situ models and QLF for the study of coronal caries. Journal of Dentistry. 2005;33(3 SPEC. ISS.):235-41.	Excluded by title
217	Hintze H, Wenzel A, Frydenberg M. Accuracy of caries detection with four storage phosphor systems and E-speed radiographs. Dentomaxillofacial Radiology. 2002;31(3):170-5.	Excluded by title
218	Holmen L, Mejare I, Malmgren B, Thylstrup A. The effect of regular professional plaque removal on dental caries in vivo. A polarized light and scanning electron microscope study. Caries research. 1988;22(4).	Excluded by title
219	Horuztepe SA, Baseren M. Effect of resin infiltration on the color and microhardness of bleached white-spot lesions in bovine enamel (an in vitro study). Journal of Esthetic and Restorative Dentistry. 2017;29(5):378-85.	Excluded by title
220	Iheozor-Ejiofor Z, Worthington HV, Walsh T, O'Malley L, Clarkson JE, Macey R, et al. Water fluoridation for the prevention of dental caries. Cochrane Database Syst Rev 2015(6).	Excluded by title
221	Indrapriyadharshini K, Madan Kumar PD, Sharma K, Iyer K. Remineralizing potential of CPP-ACP in white spot lesions - A systematic review. Indian J Dent Res. 2018;29(4):487-96.	Excluded by title
222	Innes NPT, Ricketts D, Chong LY, Keightley AJ, Lamont T, Santamaria RM. Preformed crowns for decayed primary molar teeth. Cochrane Database Syst Rev 2015(12).	Excluded by title
223	Ionta FQ, Alencar CRB, Santos NMD, Bergantin BTP, Val PP, Honorio HM, et al. Effect of palm oil alone or associated to stannous solution on enamel erosive-abrasive wear: A randomized in situ/ex vivo study. Arch Oral Biol. 2018;95:68-73.	Excluded by title
224	Ionta FQ, Mendonca FL, de Oliveira GC, de Alencar CR, Honorio HM, Magalhaes AC, et al. In vitro assessment of artificial saliva formulations on initial enamel erosion remineralization. J Dent. 2014;42(2):175-9.	Excluded by title
225	Ishii T, Yamaguchi H. Influence of extraoral lateral force loading on the mandible in the mandibular development of growing rats. Am J Orthod Dentofacial Orthop. 2008;134(6):782-91.	Excluded by title
226	Jablonski-Momeni A, Heinzel-Gutenbrunner M. Efficacy of the self-assembling peptide P11-4 in constructing a remineralization scaffold on artificially-induced enamel lesions on smooth surfaces. J Orofac Orthop 2014;75(3):175-90.	Excluded by title
227	Jahanbin A, Ameri H, Shahabi M, Ghazi A. Management of Post-orthodontic White Spot Lesions and Subsequent Enamel Discoloration with Two Microabrasion Techniques. J Dent (Shiraz). 2015;16(1 Suppl):56-60.	Excluded by title
228	Jeronymo RDI, Gonçalves LL, Torres CRG, Gomes APM, Huhtala MFRL, Borges AB, et al. Effect of caries infiltration technique and fluoride therapy on the bond strength of the demineralized enamel. Braz dent sci. 2012;15(3):43-9.	Excluded by title
229	Johnson TB, Siderits B, Nye S, Jeong YH, Han SH, Rhyu IC, et al. Effect of guided bone regeneration on bone quality surrounding dental implants. J Biomech. 2018.	Excluded by title
230	Karabekiroglu S, Kahraman FB, Unlu N. Effectiveness of different preventive agents on initial occlusal and proximal caries lesions: A follow-up study. Journal of Dental Sciences. 2018;13(2):109-15.	Excluded by title
231	Karabekiroglu S, Unlu N, Kucukyilmaz E, Sener S, Botsali MS, Malkoc S. Treatment of post-orthodontic white spot lesions with CPP-ACP paste: A three year follow up study. Dent Mater J. 2017;36(6):791-7.	Excluded by title
232	Khaddam M, Salmon B, Le Denmat D, Tjaderhane L, Menashi S, Chaussain C, et al. Grape seed extracts inhibit dentin matrix degradation by MMP-3. Frontiers in Physiology. 2014;5(OCT).	Excluded by title
233	Kim S, Kim EY, Jeong TS, Kim JW. The evaluation of resin infiltration for masking labial enamel white spot lesions. International Journal of Paediatric Dentistry. 2011;21(4):241-8.	Excluded by title
234	Kjær I, Nolting D. The human periodontal membrane focusing on the spatial interrelation between the epithelial layer of Malassez, fibers, and innervation. Acta Odontologica Scandinavica. 2009;67(3):134-8.	Excluded by title
235	Kleber CJ, Milleman JL, Davidson KR, Putt MS, Triol CW, Winston AE. Treatment of Orthodontic White Spot Lesions with a Remineralizing Dentifrice Applied by Toothbrushing or Mouth Trays. Journal of Clinical Dentistry. 1999;10(1):44-9.	Excluded by title
236	Kleber CJ, Milleman JL, Davidson KR, Putt MS. Effect of remineralizing dentifrice on orthodontic white spots after 3 months. Journal of dental research. 1998;77(Spec B):843, Abstract no: 1692.	Excluded by title
237	Krishnan V, Bhatia A, Varma H. Development, characterization and comparison of two strontium doped nano hydroxyapatite molecules for enamel repair/regeneration. Dental Materials. 2016;32(5):646-59.	Excluded by title
238	Kwak HH, Park HD, Yoon HR, Kang MK, Koh KS, Kim HJ. Topographic anatomy of the inferior wall of the maxillary sinus in Koreans. International Journal of Oral and Maxillofacial Surgery. 2004;33(4):382-8.	Excluded by title
239	Linton JL. Quantitative measurements of remineralization of incipient caries. Am J Orthod Dentofacial Orthop 1996;110(6):590-7.	Excluded by title
240	Littlewood SJ, Millett DT, Doubleday B, Bearn DR, Worthington HV. Retention procedures for stabilising tooth position after treatment with orthodontic braces. Cochrane Database Syst Rev 2016(1).	Excluded by title
241	Liu L, Zou M. [Electronic probe analysis of enamel remineralization effect of casein phosphopeptide-amorphous calcium phosphate promoted by different concentrations of fluorine]. Zhonghua Kou Qiang Yi Xue Za Zhi. 2018;53(7):470-4.	Excluded by title
242	Liu Y, Zhang L, Niu LN, Yu T, Xu HHK, Weir MD, et al. Antibacterial and remineralizing orthodontic adhesive containing quaternary ammonium resin monomer and amorphous calcium phosphate nanoparticles. Journal of Dentistry. 2018;72:53-63.	Excluded by title
243	Lodi G, Franchini R, Warnakulasuriya S, Varoni EM, Sardella A, Kerr AR, et al. Interventions for treating oral leukoplakia to prevent oral cancer. Cochrane Database Syst Rev 2016(7).	Excluded by title
244	Maia LC, de Souza IP, Cury JA. Effect of a combination of fluoride dentifrice and varnish on enamel surface rehardening and fluoride uptake in vitro. Eur J Oral Sci. 2003;111(1):68-72.	Excluded by title
245	Massara ML, Alves JB, Brandão PR. Atraumatic restorative treatment: clinical, ultrastructural and chemical analysis. Caries research. 2002;36(6):430-6.	Excluded by title
246	Melsen B, Huja SS, Chien HH, Dalstra M. Alveolar bone preservation subsequent to miniscrew implant placement in a canine model. Orthod Craniofac Res. 2015;18(2):77-85.	Excluded by title
247	Miresmaeili A, Etrati Khosroshahi M, Motahary P, Rezaei-Soufi L, Mahjub H, Dadashi M, et al. Effect of Argon Laser on Enamel Demineralization around Orthodontic Brackets: An In Vitro Study. J Dent (Tehran). 2014;11(4):411-7.	Excluded by title
248	Mirhashemi AH, Hakimi S, Ahmad Akhoundi MS, Chiniforush N. Prevention of Enamel Adjacent to Bracket Demineralization Following Carbon Dioxide Laser Radiation and Titanium Tetra Fluoride Solution Treatment: An In Vitro Study. J Lasers Med Sci. 2016;7(3):192-6.	Excluded by title

249	Mohamed AM, Wong KH, Lee WJ, Marizan Nor M, Mohd Hussaini H, Rosli TI. In vitro study of white spot lesion: Maxilla and mandibular teeth. Saudi Dent J. 2018;30(2):142-50.	Excluded by title
250	Mohanty P, Padmanabhan S, Chitharanjan AB. An in Vitro Evaluation of Remineralization Potential of Novamin((R)) on Artificial Enamel Sub-Surface Lesions Around Orthodontic Brackets Using Energy Dispersive X-Ray Analysis (EDX). J Clin Diagn Res. 2014;8(11):Zc88-91.	Excluded by title
251	Mohd Said SN, Ekambaram M, Yiu CK. Effect of different fluoride varnishes on remineralization of artificial enamel carious lesions. Int J Paediatr Dent. 2017;27(3):163-73.	Excluded by title
252	Nahuelhuaique Fuentealba P, Díaz Meléndez J, Sandoval Vidal P. Resin infiltration: An effective and minimally invasive treatment for the treatment of non-cavitated white lesions. narrative review. Avances en Odontoestomatologia. 2017;33(3):121-6.	Excluded by title
253	Nakabayashi N, Watanabe A, Ikeda W. Intra-oral bonding of 4-META/MMA-TBB resin to vital human dentin. American journal of dentistry. 1995;8(1):37-42.	Excluded by title
254	Nassur C, Alexandria AK, Pomarico L, de Sousa VP, Cabral LM, Maia LC. Characterization of a new TiF(4) and beta-cyclodextrin inclusion complex and its in vitro evaluation on inhibiting enamel demineralization. Arch Oral Biol. 2013;58(3):239-47.	Excluded by title
255	Nemcovsky CE, Beny L, Shanberger S, Feldman-Herman S, Vardimon A. Bone apposition in surgical bony defects following orthodontic movement: A comparative histomorphometric study between root- and periodontal ligament-damaged and periodontally intact rat molars. Journal of Periodontology. 2004;75(7):1013-9.	Excluded by title
256	Neuhaus KW, Graf M, Lussi A, Katsaros C. Late infiltration of post-orthodontic white spot lesions. Journal of Orofacial Orthopedics. 2010;71(6):442-7.	Excluded by title
257	Neves AA, Primo LG, Ramos PR. Microscopic investigation of artificially demineralized surface enamel exposed to controlled intra-oral periods. Australian dental journal. 2003;48(4):248-54.	Excluded by title
258	Newman GV, Newman RA, Sengupta AK. Comparative assessment of light-cured resin-modified glass ionomer and composite resin adhesives: In vitro study of a new adhesive system. Am J Orthod Dentofacial Orthop 2001;119(3):256-62.	Excluded by title
259	Nociti Jr FH, Neto JBC, Carvalho MD, Sallum EA, Sallum AW. Intermittent cigarette smoke inhalation may affect bone volume around titanium implants in rats. Journal of Periodontology. 2002;73(9):982-7.	Excluded by title
260	Nozari A, Ajami S, Rafiei A, Niazi E. Impact of Nano Hydroxyapatite, Nano Silver Fluoride and Sodium Fluoride Varnish on Primary Teeth Enamel Remineralization: An In Vitro Study. J Clin Diagn Res. 2017;11(9):Zc97-zc100.	Excluded by title
261	Ogasawara T, Yoshimine Y, Kiyoshima T, Kobayashi I, Matsuo K, Akamine A, et al. In situ expression of RANKL, RANK, osteoprotegerin and cytokines in osteoclasts of rat periodontal tissue. Journal of Periodontal Research. 2004;39(1):42-9.	Excluded by title
262	Olivares Espinoza JA, Sáenz Pasco GJ. Fuerzas de adhesión de un sistema adhesivo de quinta generación en superficies dentarias tratadas con agentes químico-mecánicos. Odontol pediatr (Lima). 2013;12(1):6-13.	Excluded by title
263	O'Mahony G, Millett DT, Cronin MS, McIntyre GT, Barry MK. The relationship between tooth size discrepancy and archform classification in orthodontic patients. J Clin Exp Dent. 2015;7(2):e268-72.	Excluded by title
264	Pandis N, Vlachopoulos K, Polychronopoulou A, Madianos P, Eliades T. Periodontal condition of the mandibular anterior dentition in patients with conventional and self-ligating brackets. Orthodontics & Craniofacial Research. 2008;11(4):211-5.	Excluded by title
265	Papadopoulos-Markopoulos CE, Dereka XE, Vavouraki EN, Vrotsos IA. In vitro evaluation of the mitogenic effect of platelet-derived growth factor-BB on human periodontal ligament cells cultured with various bone allografts. Journal of Periodontology. 2003;74(4):451-7.	Excluded by title
266	Park SM, Kim DH, Pang EK. Bone formation of demineralized human dentin block graft with different demineralization time: In vitro and in vivo study. Journal of Cranio-Maxillofacial Surgery. 2017;45(6):903-12.	Excluded by title
267	Pereira-Cenci T, Cenci MS, Fedorowicz Z, Azevedo M. Antibacterial agents in composite restorations for the prevention of dental caries. Cochrane Database Syst Rev 2013(12).	Excluded by title
268	Petersson LG, Edwardsson S, Koch G, Kurol J, Lodding A. The effect of a low fluoride containing toothpaste on the development of dental caries and microbial composition using a caries generating model device in vivo. Swedish dental journal. 1995;19(3):83-94.	Excluded by title
269	Poklepovic T, Worthington HV, Johnson TM, Sambunjak D, Imai P, Clarkson JE, et al. Interdental brushing for the prevention and control of periodontal diseases and dental caries in adults. Cochrane Database Syst Rev 2013(12).	Excluded by title
270	Premaraj TS, Rohani N, Covey D, Premaraj S, Hua Y, Watanabe H. An in-vitro evaluation of mechanical and esthetic properties of orthodontic sealants. Eur J Dent. 2014;8(4):487-92.	Excluded by title
271	Radlanski RJ, Renz H, Reulen A. Distribution of the cement film beneath the orthodontic band: A morphometric in vitro study. Journal of Orofacial Orthopedics. 2003;64(4):284-92.	Excluded by title
272	Raphael S, Blinkhorn A. Is there a place for Tooth Mousse® in the prevention and treatment of early dental caries? A systematic review. BMC Oral Health. 2015;15(1).	Excluded by title
273	Rasines Alcaraz MG, Veitz-Keenan A, Sahrmann P, Schmidlin PR, Davis D, Iheozor-Ejiofor Z. Direct composite resin fillings versus amalgam fillings for permanent or adult posterior teeth. Cochrane Database Syst Rev 2014(3).	Excluded by title
274	Raszewski Z, Nowakowska-Toporowska A, Weżgowiec J, Nowakowska D. Effect of water quantity and quality on the properties of alginate impression materials. Dental and Medical Problems. 2018;55(1):43-8.	Excluded by title
275	Rechmann P, Bekmezian S, Rechmann BMT, Chaffee BW, Featherstone JDB. MI Varnish and MI Paste Plus in a caries prevention and remineralization study: a randomized controlled trial. Clin Oral Investig. 2018;22(6):2229-39.	Excluded by title
276	Rechmann P, Fried D, Le CQ, Nelson G, Rapozo-Hilo M, Rechmann BMT, et al. Inhibition of caries in vital teeth by CO2 laser treatment. Lasers in Dentistry Xiv. Proceedings of SPIE. 68432008.	Excluded by title
277	Rezklega F, Ogaard B. Tensile Bond Force of Glass Ionomer Cements in Direct Bonding of Orthodontic Brackets - an Invitro Comparative-Study. Am J Orthod Dentofacial Orthop 1991;100(4):357-61.	Excluded by title
278	Ricketts D, Lamont T, Innes NPT, Kidd E, Clarkson JE. Operative caries management in adults and children. Cochrane Database Syst Rev 2013(3).	Excluded by title
279	Riley P, Lamont T. Triclosan/copolymer containing toothpastes for oral health. Cochrane Database Syst Rev 2013(12).	Excluded by title
280	Riley P, Moore D, Ahmed F, Sharif MO, Worthington HV. Xylitol-containing products for preventing dental caries in children and adults. Cochrane Database Syst Rev 2015(3).	Excluded by title
281	Rios D, Magalhaes AC, Machado MA, da Silva SM, Lizarelli Rde F, Bagnato VS, et al. In vitro evaluation of enamel erosion after Nd:YAG laser irradiation and fluoride application. Photomed Laser Surg. 2009;27(5):743-7.	Excluded by title
282	Roth SF, Heo G, Varnhagen C, Glover KE, Major PW. Occupational stress among Canadian orthodontists. Angle Orthodontist. 2003;73(1):43-50.	Excluded by title
283	Safitri NM, Anggani HS, Purwanegara MK, Sumardi S. Enamel surface quality improvement in white spot lesions after orthodontic treatment using a microabrasion technique with fluoride or calcium phosphopeptide-amorphous calcium phosphate application. International Journal of Applied Pharmaceutics. 2017;9(Special Issue 2):114-6.	Excluded by title
284	Sambunjak D, Nickerson JW, Poklepovic T, Johnson TM, Imai P, Tugwell P, et al. Flossing for the management of periodontal diseases and dental caries in adults. Cochrane Database Syst Rev 2011(12).	Excluded by title
285	Schatzle M, Sener B, Schmidlin PR, Imfeld T, Attin T. In vitro tooth cleaning efficacy of electric toothbrushes around brackets. Eur J Orthod 2010;32(5):481-9.	Excluded by title
286	Schlueter N, Klimek J, Ganss C. Effect of a chitosan additive to a Sn2+-containing toothpaste on its anti-erosive/anti-abrasive efficacy-a controlled randomised in situ trial. Clinical Oral Investigations. 2014;18(1):107-15.	Excluded by title
287	Sehgal V, Shetty VS, Mogra S, Bhat G, Eipe M, Jacob S, et al. Evaluation of antimicrobial and physical properties of orthodontic composite resin modified by addition of antimicrobial agents - an in-vitro study. Am J Orthod Dentofacial Orthop 2007;131(4):525-9.	Excluded by title
288	Şen S, Erber R, Kunzmann K, Kirschner S, Weyer V, Schilling L, et al. Assessing abrasion of orthodontic surface sealants using a modified ophthalmic optical coherence tomography device. Clinical Oral Investigations. 2018:1-15.	Excluded by title
289	Shiraishi C, Hara Y, Abe Y, Ukai T, Kato I. A histopathological study of the role of periodontal ligament tissue in root resorption in the rat. Archives of Oral Biology. 2001;46(2):99-107.	Excluded by title
290	Shobbana Devi VR, Anand MK, Venkateswaran S, Iyer KS, Krishnaswamy NR. Comparison of shear bond strength of self-etching fluoride releasing adhesives with and without pumice prophylaxis. Indian J Dent Res. 2015;26(4):390-5.	Excluded by title
291	Sinha PK, Nanda RS, Duncanson MG, Hosier MJ. In vitro evaluation of matrix-bound fluoride-releasing orthodontic bonding adhesives. Am J Orthod Dentofacial Orthop 1997;111(3):276-82.	Excluded by title
292	Sorake A, Rai R, Hegde G, Suneja R, Kumar N, Skaria J. Comparison of Shear Bond Strength of New Self-etching Primer with Conventional Self-etching Primers: An In-vitro Study. J Int Oral Health. 2015;7(7):17-21.	Excluded by title
293	Stafuzza TC. Estudo clínico randomizado de três materiais capeadores pulpares após remoção parcial de cárie em dentes decíduos. 2017:67-.	Excluded by title
294	Stahl SS, Froum S. Human suprabony healing responses following root demineralization and coronal flap anchorage: Histologic responses in 7 sites. Journal of Clinical Periodontology. 1991;18(9):685-9.	Excluded by title
295	Staudt CB, Lussi A, Jacquet J, Kiliaridis S. White spot lesions around brackets: In vitro detection by laser fluorescence. European Journal of Oral Sciences. 2004;112(3):237-43.	Excluded by title
296	Taha AA, Fleming PS, Hill RG, Patel MP. Enamel Remineralization with Novel Bioactive Glass Air Abrasion. J Dent Res. 2018:22034518792048.	Excluded by title
297	Taha AA, Patel MP, Hill RG, Fleming PS. The effect of bioactive glasses on enamel remineralization: A systematic review. Journal of Dentistry. 2017;67:9-17.	Excluded by title
298	Tarvade SM, Deshmukh AA, Daokar SG. Evaluation of Bond Strength: An In vitro Study using Pro Seal. J Int Oral Health. 2014;6(4):1-3.	Excluded by title
299	Torlakovic L, Klepac-Ceraj V, Øgaard B, Cotton SL, Paster BJ, Olsen I. Microbial community succession on developing lesions on human enamel. Journal of Oral Microbiology. 2012;4(2012).	Excluded by title
300	Tubert-Jeannin S, Auclair C, Amsallem E, Tramini P, Gerbaud L, Ruffieux C, et al. Fluoride supplements (tablets, drops, lozenges or chewing gums) for preventing dental caries in children. Cochrane Database Syst Rev 2011(12).	Excluded by title
301	Tüfekçi E, Merrill TE, Pintado MR, Beyer JP, Brantley WA, Campbell PM. Enamel loss associated with orthodontic adhesive removal on teeth with white spot lesions: An in vitro study. Am J Orthod Dentofacial Orthop 2004;125(6):733-40.	Excluded by title
302	Vorhies AB, Donly KJ, Staley RN, Wefel JS. Enamel demineralization adjacent to orthodontic brackets bonded with hybrid glass ionomer cements: An in vitro study. Am J Orthod Dentofacial Orthop 1998;114(6):668-74.	Excluded by title
303	Voudouris JC, Woodside DG, Altuna G, Kuftinec MM, Angelopoulos G, Bourque PJ. Condyle-fossa modifications and muscle interactions during Herbst treatment, part 1. New technological methods. Am J Orthod Dentofacial Orthop 2003;123(6):604-13.	Excluded by title
304	Walsh T, Oliveira-Neto JM, Moore D. Chlorhexidine treatment for the prevention of dental caries in children and adolescents. Cochrane Database Syst Rev 2015(4).	Excluded by title
305	Wang LL, Zhu H, Liang T. Changes of transforming growth factor beta 1 in rat periodontal tissue during orthodontic tooth movement. Chin J Dent Res. 2000;3(1):19-22.	Excluded by title
306	Woodnutt DA, Byers MR. Morphological variation in the tyrosine receptor kinase A-immunoreactive periodontal ligament epithelium of developing and mature rats. Archives of Oral Biology. 2001;46(2):163-71.	Excluded by title
307	Wu G, Liu X, Hou Y. Analysis of the effect of CPP-ACP tooth mousse on enamel remineralization by circularly polarized images. Angle Orthod. 2010;80(5):933-8.	Excluded by title
308	Yagihashi K, Miyazawa K, Togari K, Goto S. Demineralized dentin matrix acts as a scaffold for repair of articular cartilage defects. Calcif Tissue Int. 2009;84(3):210-20.	Excluded by title
309	Yamashita JM, Torres NM, Moura-Grec PG, Marsicano JA, Sales-Peres A, Sales-Peres SH. Role of arginine and fluoride in the prevention of eroded enamel: an in vitro model. Aust Dent J. 2013;58(4):478-82.	Excluded by title
310	Yassaei S, Shahraki N, Aghili H, Davari A. Combined effects of Er: YAG laser and casein phosphopeptide-amorphous calcium phosphate on the inhibition of enamel demineralization: An in vitro study. Dent Res J (Isfahan). 2014;11(2):193-8.	Excluded by title
311	Zarta OL, Zuluaga Valencia AL, Huertas Diaz MC, Lara JS, Quintero IK, Téllez M, et al. Penetración de tres adhesivos en lesionesinterproximales de caries de mancha blanca: estudio in vitro. Rev Fac Odontol Univ Antioq. 2012;24(1):84-95.	Excluded by title
312	Zheng H, Lu L, Song JL, Gao X, Deng F, Wang ZB. [Low intensity pulsed ultrasound combined with guided tissue regeneration for promoting the repair of defect at canines periodontal fenestration in Beagle dogs]. Zhonghua Kou Qiang Yi Xue Za Zhi. 2011;46(7):431-6.	Excluded by title

313	Zingler S, Matthei B, Diercke K, Frese C, Ludwig B, Kohl A, et al. Biological evaluation of enamel sealants in an organotypic model of the human gingiva. Dental Materials. 2014;30(9):1039-51.	Excluded by title
314	Al Maaitah EF, Adeyemi AA, Higham SM, Pender N, Harrison JE. Factors affecting demineralization during orthodontic treatment: a post-hoc analysis of RCT recruits. Am J Orthod Dentofacial Orthop. 2011;139(2):181-91.	Excluded by abstract
315	Aljehani A, Tranaeus S, Forsberg CM, Angmar-Mansson B, Shi XQ. In vitro quantification of white spot enamel lesions adjacent to fixed orthodontic appliances using quantitative light-induced fluorescence and DIAGNOdent. Acta Odontol Scand. 2004;62(6):313-8.	Excluded by abstract
316	Al-Mulla A, Karlsson L, Kharsa S, Kjellberg H, Birkhed D. Combination of high-fluoride toothpaste and no post-brushing water rinsing on enamel demineralization using an in-situ caries model with orthodontic bands. Acta Odontol Scand. 2010;68(6):323-8.	Excluded by abstract
317	Andersson A, Skold-Larsson K, Hallgren A, Petersson LG, Twetman S. Effect of a dental cream containing amorphous cream phosphate complexes on white spot lesion regression assessed by laser fluorescence. Oral Health Prev Dent. 2007;5(3):229-33.	Excluded by abstract
318	Arhun N, Arman A, Cehreli SB, Arikan S, Karabulut E, Gulsahi K. Microleakage beneath ceramic and metal brackets bonded with a conventional and an antibacterial adhesive system. Angle Orthod. 2006;76(6):1028-34.	Excluded by abstract
319	Bailey DL, Adams GG, Tsao CE, Hyslop A, Escobar K, Manton DJ, et al. Regression of post-orthodontic lesions by a remineralizing cream. J Dent Res. 2009;88(12):1148-53.	Excluded by abstract
320	Ballard RW, Hagan JL, Phaup AN, Sarkar N, Townsend JA, Armbruster PC. Evaluation of 3 commercially available materials for resolution of white spot lesions. Am J Orthod Dentofacial Orthop. 2013;143(4 Suppl):S78-84.	Excluded by abstract
321	Baysal A, Ulusoy SN, Uysal T. Evaluation of enamel demineralization in adolescents after rapid maxillary expansion using the quantitative light-induced fluorescence method: A single-center, randomized controlled clinical trial. Am J Orthod Dentofacial Orthop. 2016;150(5):731-9.	Excluded by abstract
322	Benson PE, Ali Shah A, Robert Willmot D. Polarized versus nonpolarized digital images for the measurement of demineralization surrounding orthodontic brackets. Angle Orthod. 2008;78(2):288-93.	Excluded by abstract
323	Benson PE, Pender N, Higham SM. An in situ caries model to study demineralisation during fixed orthodontics. Clin Orthod Res. 1999;2(3):143-53.	Excluded by abstract
324	Benson PE, Pender N, Higham SM. Quantifying enamel demineralization from teeth with orthodontic brackets--a comparison of two methods. Part 1: repeatability and agreement. Eur J Orthod. 2003;25(2):149-58.	Excluded by abstract
325	Benson PE, Shah AA, Willmot DR. Measurement of white lesions surrounding orthodontic brackets: captured slides vs digital camera images. Angle Orthod. 2005;75(2):226-30.	Excluded by abstract
326	Bishara SE, Soliman M, Laffoon JF, Warren J. Shear bond strength of a new high fluoride release glass ionomer adhesive. Angle Orthod. 2008;78(1):125-8.	Excluded by abstract
327	Bock NC, von Bremen J, Kraft M, Ruf S. Plaque control effectiveness and handling of interdental brushes during multibracket treatment--a randomized clinical trial. Eur J Orthod. 2010;32(4):408-13.	Excluded by abstract
328	Brown MD, Campbell PM, Schneiderman ED, Buschang PH. A practice-based evaluation of the prevalence and predisposing etiology of white spot lesions. Angle Orthod. 2016;86(2):181-6.	Excluded by abstract
329	Buyukyilmaz T, Tangugsorn V, Ogaard B, Arends J, Ruben J, Rolla G. The effect of titanium tetrafluoride (TiF4) application around orthodontic brackets. Am J Orthod Dentofacial Orthop. 1994;105(3):293-6.	Excluded by abstract
330	Cantekin K, Buyuk SK. Shear bond strength of a new low-shrinkage flowable composite for orthodontic bracket bonding. J Dent Child (Chic). 2014;81(2):63-6.	Excluded by abstract
331	Casals E, Boukpessi T, McQueen CM, Eversole SL, Faller RV. Anticaries potential of commercial dentifrices as determined by fluoridation and remineralization efficiency. J Contemp Dent Pract. 2007;8(7):1-10.	Excluded by abstract
332	Chen Y, Zhou Y, Li SJ, Fang P, Wei Y, Tang JW. [Effect of the complex of casein phosphopeptide and amorphous calcium phosphate on reducing enamel demineralization and promoting remineralization]. Zhonghua Kou Qiang Yi Xue Za Zhi. 2013;48(1):32-6.	Excluded by abstract
333	Davari A, Yassaei S, Karandish M, Zarghami F. In vitro evaluation of microleakage under ceramic and metal brackets bonded with LED and plasma arc curing. J Contemp Dent Pract. 2012;13(5):644-9.	Excluded by abstract
334	de Moura MS, de Melo Simplicio AH, Cury JA. In-vivo effects of fluoridated antiplaque dentifrice and bonding material on enamel demineralization adjacent to orthodontic appliances. Am J Orthod Dentofacial Orthop. 2006;130(3):357-63.	Excluded by abstract
335	Demling A, Elter C, Heidenblut T, Bach FW, Hahn A, Schwestka-Polly R, et al. Reduction of biofilm on orthodontic brackets with the use of a polytetrafluoroethylene coating. Eur J Orthod. 2010;32(4):414-8.	Excluded by abstract
336	Derks A, Frencken J, Bronkhorst E, Kuijpers-Jagtman AM, Katsaros C. Effect of chlorhexidine varnish application on mutans streptococci counts in orthodontic patients. Am J Orthod Dentofacial Orthop. 2008;133(3):435-9.	Excluded by abstract
337	Dunn WJ. Shear bond strength of an amorphous calcium-phosphate-containing orthodontic resin cement. Am J Orthod Dentofacial Orthop. 2007;131(2):243-7.	Excluded by abstract
338	Elkhadem A, Orabi N. Weak evidence suggests higher risk for bracket bonding failure with self-etch primer compared to conventional acid etch over 12 months. Evid Based Dent. 2013;14(2):52-3.	Excluded by abstract
339	Eminkahyagil N, Korkmaz Y, Gokalp S, Baseren M. Shear bond strength of orthodontic brackets with newly developed antibacterial self-etch adhesive. Angle Orthod. 2005;75(5):843-8.	Excluded by abstract
340	Farrow ML, Newman SM, Oesterle LJ, Shellhart WC. Filled and unfilled restorative materials to reduce enamel decalcification during fixed-appliance orthodontic treatment. Am J Orthod Dentofacial Orthop. 2007;132(5):578.e1-6.	Excluded by abstract
341	Fekrazad R, Ebrahimpour L. Evaluation of acquired acid resistance of enamel surrounding orthodontic brackets irradiated by laser and fluoride application. Lasers Med Sci. 2014;29(6):1793-8.	Excluded by abstract
342	Glasspoole EA, Erickson RL, Davidson CL. Demineralization of enamel in relation to the fluoride release of materials. Am J Dent. 2001;14(1):8-12.	Excluded by abstract
343	Gorton J, Featherstone JD. In vivo inhibition of demineralization around orthodontic brackets. Am J Orthod Dentofacial Orthop. 2003;123(1):10-4.	Excluded by abstract
344	Heintze SD, Jost-Brinkmann PG, Loundos J. Effectiveness of three different types of electric toothbrushes compared with a manual technique in orthodontic patients. Am J Orthod Dentofacial Orthop. 1996;110(6):630-8.	Excluded by abstract
345	Hess E, Campbell PM, Honeyman AL, Buschang PH. Determinants of enamel decalcification during simulated orthodontic treatment. Angle Orthod. 2011;81(5):836-42.	Excluded by abstract
346	Hildebrand NK, Raboud DW, Heo G, Nelson AE, Major PW. Argon laser vs conventional visible light-cured orthodontic bracket bonding: an in-vivo and in-vitro study. Am J Orthod Dentofacial Orthop. 2007;131(4):530-6.	Excluded by abstract
347	Ireland AJ, Soro V, Sprague SV, Harradine NW, Day C, Al-Anezi S, et al. The effects of different orthodontic appliances upon microbial communities. Orthod Craniofac Res. 2014;17(2):115-23.	Excluded by abstract
348	Julien KC, Buschang PH, Campbell PM. Prevalence of white spot lesion formation during orthodontic treatment. Angle Orthod. 2013;83(4):641-7.	Excluded by abstract
349	Knosel M, Bojes M, Jung K, Ziebolz D, Renger S. [Increased susceptibility for white spot lesions by surplus orthodontic etching exceeding bracket base area]. Orthod Fr. 2015;86(3):233-44.	Excluded by abstract
350	Knosel M, Forslund L, Jung K, Ziebolz D. Efficacy of different strategies in protecting enamel against demineralization during fixed orthodontic treatment. J Orofac Orthop. 2012;73(3):194-203.	Excluded by abstract
351	Knosel M, Klang E, Helms HJ, Wiechmann D. Lingual orthodontic treatment duration: performance of two different completely customized multi-bracket appliances (Incognito and WIN) in groups with different treatment complexities. Head Face Med. 2014;10:46.	Excluded by abstract
352	Kucuk EB, Malkoc S, Demir A. Microcomputed tomography evaluation of white spot lesion remineralization with various procedures. Am J Orthod Dentofacial Orthop. 2016;150(3):483-90.	Excluded by abstract
353	Liu L, Yang L, Zou M. [Remineralization of enamel promoted by casein phosphopeptide-amorphous calcium phosphate with different concentration of fluorin]. Shanghai Kou Qiang Yi Xue. 2013;22(5):533-6.	Excluded by abstract
354	Louie T, Lee C, Hsu D, Hirasuna K, Manesh S, Staninec M, et al. Clinical assessment of early tooth demineralization using polarization sensitive optical coherence tomography. Lasers Surg Med. 2010;42(10):738-45.	Excluded by abstract
355	Lovrov S, Hertrich K, Hirschfelder U. Enamel Demineralization during Fixed Orthodontic Treatment - Incidence and Correlation to Various Oral-hygiene Parameters. J Orofac Orthop. 2007;68(5):353-63.	Excluded by abstract
356	Mayne RJ, Cochrane NJ, Cai F, Woods MG, Reynolds EC. In-vitro study of the effect of casein phosphopeptide amorphous calcium fluoride phosphate on iatrogenic damage to enamel during orthodontic adhesive removal. Am J Orthod Dentofacial Orthop. 2011;139(6):e543-51.	Excluded by abstract
357	Melo MA, Wu J, Weir MD, Xu HH. Novel antibacterial orthodontic cement containing quaternary ammonium monomer dimethylaminododecyl methacrylate. J Dent. 2014;42(9):1193-201.	Excluded by abstract
358	Mensinkai PK, Ccahuana-Vasquez RA, Chedjieu I, Amaechi BT, Mackey AC, Walker TJ, et al. In situ remineralization of white-spot enamel lesions by 500 and 1,100 ppm F dentifrices. Clin Oral Investig. 2012;16(4):1007-14.	Excluded by abstract
359	Miura KK, Ito IY, Enoki C, Elias AM, Matsumoto MA. Anticariogenic effect of fluoride-releasing elastomers in orthodontic patients. Braz Oral Res. 2007;21(3):228-33.	Excluded by abstract
360	Moosavi H, Ahrari F, Mohamadipour H. The effect of different surface treatments of demineralised enamel on microleakage under metal orthodontic brackets. Prog Orthod. 2013;14:2.	Excluded by abstract
361	Murakami C, Bonecker M, Correa MS, Mendes FM, Rodrigues CR. Effect of fluoride varnish and gel on dental erosion in primary and permanent teeth. Arch Oral Biol. 2009;54(11):997-1001.	Excluded by abstract
362	Paschoal MA, Moura CM, Jeremias F, Souza JF, Bagnato VS, Giusti JS, et al. Longitudinal effect of curcumin-photodynamic antimicrobial chemotherapy in adolescents during fixed orthodontic treatment: a single-blind randomized clinical trial study. Lasers Med Sci. 2015;30(8):2059-65.	Excluded by abstract
363	Paschos E, Galosi T, Huth KC, Rudzki I, Wichelhaus A, Kunzelmann KH. Do bonding agents protect the bracket-periphery?--Evaluation by consecutive muCT scans and fluorescence measurements. Clin Oral Investig. 2015;19(1):159-68.	Excluded by abstract
364	Paschos E, Kleinschrodt T, Clementino-Luedemann T, Huth KC, Hickel R, Kunzelmann KH, et al. Effect of different bonding agents on prevention of enamel demineralization around orthodontic brackets. Am J Orthod Dentofacial Orthop. 2009;135(5):603-12.	Excluded by abstract
365	Pascotto RC, Navarro MF, Capelozza Filho L, Cury JA. In vivo effect of a resin-modified glass ionomer cement on enamel demineralization around orthodontic brackets. Am J Orthod Dentofacial Orthop. 2004;125(1):36-41.	Excluded by abstract
366	Poosti M, Ahrari F, Moosavi H, Najjaran H. The effect of fractional CO2 laser irradiation on remineralization of enamel white spot lesions. Lasers Med Sci. 2014;29(4):1349-55.	Excluded by abstract
367	Poosti M, Ramazanzadeh B, Zebarjad M, Javadzadeh P, Naderinasab M, Shakeri MT. Shear bond strength and antibacterial effects of orthodontic composite containing TiO2 nanoparticles. Eur J Orthod. 2013;35(5):676-9.	Excluded by abstract
368	Restrepo M, Bussaneli DG, Jeremias F, Cordeiro RC, Magalhaes AC, Palomari Spolidorio DM, et al. Control of white spot lesion adjacent to orthodontic bracket with use of fluoride varnish or chlorhexidine gel. ScientificWorldJournal. 2015;2015:218452.	Excluded by abstract
369	Richter AE, Arruda AO, Peters MC, Sohn W. Incidence of caries lesions among patients treated with comprehensive orthodontics. Am J Orthod Dentofacial Orthop. 2011;139(5):657-64.	Excluded by abstract
370	Samuel SR, Dorai S, Khatri SG, Patil ST. Effect of ozone to remineralize initial enamel caries: in situ study. Clin Oral Investig. 2016;20(5):1109-13.	Excluded by abstract
371	Senestraro SV, Crowe JJ, Wang M, Vo A, Huang G, Ferracane J, et al. Minimally invasive resin infiltration of arrested white-spot lesions: a randomized clinical trial. J Am Dent Assoc. 2013;144(9):997-1005.	Excluded by abstract
372	Singh S, Singh SP, Goyal A, Utreja AK, Jena AK. Effects of various remineralizing agents on the outcome of post-orthodontic white spot lesions (WSLs): a clinical trial. Prog Orthod. 2016;17(1):25.	Excluded by abstract
373	Todd MA, Staley RN, Kanellis MJ, Donly KJ, Wefel JS. Effect of a fluoride varnish on demineralization adjacent to orthodontic brackets. Am J Orthod Dentofacial Orthop. 1999;116(2):159-67.	Excluded by abstract
374	Uysal T, Amasyali M, Koyuturk AE, Ozcan S, Sagdic D. Amorphous calcium phosphate-containing orthodontic composites. Do they prevent demineralisation around orthodontic brackets? Aust Orthod J. 2010;26(1):10-5.	Excluded by abstract

375	VanMiller EJ, Donly KJ. Enamel demineralization inhibition by cements at orthodontic band margins. Am J Dent. 2003;16(5):356-8.	Excluded by abstract
376	Visel D, Jacker T, Jost-Brinkmann PG, Prager TM. Demineralization adjacent to orthodontic brackets after application of conventional and self-etching primer systems. J Orofac Orthop. 2014;75(5):358-73.	Excluded by abstract
377	Wandera A, Garcia G. Comparative in vitro microradiographic effects of resin-modified and autopolymerizing glass ionomers on demineralization of primary and permanent enamel. ASDC J Dent Child. 1998;65(4):239-43, 29.	Excluded by abstract
378	Wang X, Wang B, Wang Y. Antibacterial orthodontic cement to combat biofilm and white spot lesions. Am J Orthod Dentofacial Orthop. 2015;148(6):974-81.	Excluded by abstract
379	Willmot DR. White lesions after orthodontic treatment: does low fluoride make a difference? J Orthod. 2004;31(3):235-42; discussion 02.	Excluded by abstract
380	Wilson RM, Donly KJ. Demineralization around orthodontic brackets bonded with resin-modified glass ionomer cement and fluoride-releasing resin composite. Pediatr Dent. 2001;23(3):255-9.	Excluded by abstract
381	Zhang CB, Sun XH, Hou X, Yan K. [Comparative studies of casein phosphopeptide-amorphous calcium phosphate and fluoride products in inhibiting enamel demineralization]. Zhonghua Kou Qiang Yi Xue Za Zhi. 2012;47(8):490-4.	Excluded by abstract
382	Zhang N, Chen C, Weir MD, Bai Y, Xu HH. Antibacterial and protein-repellent orthodontic cement to combat biofilms and white spot lesions. J Dent. 2015;43(12):1529-38.	Excluded by abstract
383	Atwa ALDA, AbuShahba RY, Mostafa M, Hashem MI. Effect of honey in preventing gingivitis and dental caries in patients undergoing orthodontic treatment. Saudi Dental Journal. 2014;26(3):108-14.	Excluded by abstract
384	Liu MT, Zhang JT, Liu B, Che XQ, Feng ZY, Ran HQ. Effect of K2TiF6 on adhesion property of dental enamel bonding resin. Chinese Journal of Tissue Engineering Research. 2012;16(34):6335-8.	Excluded by abstract
385	Mei HL, Chen LY, Zhang D, Zhang PL, Liu B, Zhao W, et al. Effects of casein phosphopeptide-stabilized amorphous calcium phosphate solution on enamel remineralization. Journal of Clinical Rehabilitative Tissue Engineering Research. 2009;13(25):4825-8.	Excluded by abstract
386	Rodrigues L, Parisotto T, Steiner-Oliveira C, Azevedo L, Tabchoury C, Nobre-Dos-Santos M. Effect of CO2 laser and fluoride dentifrice on demineralization around orthodontic brackets-an in situ study. Lasers in Surgery and Medicine. 2014;46:57.	Excluded by abstract
387	Yang TY, Deng RJ. Bonding of brackets using resin reinforced glass ionomer combined with a newly self-etching adhesive agent. Journal of Clinical Rehabilitative Tissue Engineering Research. 2009;13(34):6729-32.	Excluded by abstract
388	Zhou CH, Sun XH, Huang Y, Li B. Quantitative microradiographic analysis of remineralization of enamel lesions promoted by casein phosphopeptide amorphous calcium phosphate and fluoride. Journal of Jilin University Medicine Edition. 2008;34(6):1022-6.	Excluded by abstract
389	Zope A, Zope-Khalekar Y, Chitko SS, Kerudi VV, Patil HA, Bonde PV, et al. Comparison of self-etch primers with conventional acid etching system on orthodontic brackets. Journal of Clinical and Diagnostic Research. 2016;10(12):ZC19-ZC22.	Excluded by abstract
390	Park C, Hwang H, Lee K, Hong S. A comparative study of electric and manual toothbrushes on oral hygiene status in fixed orthodontic patients. Korean J Orthod 2004;34(4):363-70.	Excluded by abstract
391	Cehreli SB, Sar C, Polat-Ozsoy O, Unver B, Ozsoy S. Effects of a fluoride-containing casein phosphopeptide-amorphous calcium phosphate complex on the shear bond strength of orthodontic brackets. Eur J Orthod 2012;34(2):193-7.	Excluded by abstract
392	Doherty UB, Benson PE, Higham SM. Fluoride-releasing elastomeric ligatures assessed with the in situ caries model. Eur J Orthod 2002;24(4):371-8.	Excluded by abstract
393	Foster JA, Berzins DW, Bradley TG. Bond strength of an amorphous calcium phosphate-containing orthodontic adhesive. Angle Orthodontist. 2008;78(2):339-44.	Excluded by abstract
394	Garciagodoy F, Hubbard GW, Storey AT. Effect of a Fluoridated Etching Gel on Enamel Morphology and Shear Bond Strength of Orthodontic Brackets. Am J Orthod Dentofacial Orthop 1991;100(2):163-70.	Excluded by abstract
395	Heshmat H, Banava S, Mohammadi E, Kharazifard MJ, Mojtahedzadeh F. The effect of recommending a CPP-ACPF product on salivary and plaque pH levels in orthodontic patients: A randomized cross-over clinical trial. Acta Odontologica Scandinavica. 2014;72(8):903-7.	Excluded by abstract
396	Jo SY, Chong HJ, Chang EY, Chang NY, Chae JM, Cho JH, et al. Effects of various toothpastes on remineralization of white spot lesions. Korean Journal of Orthodontics. 2014;44(3):113-8.	Excluded by abstract
397	Marini I, Bortolotti F, Parenti SI, Gatto MR, Bonetti GA. Combined effects of repeated oral hygiene motivation and type of toothbrush on orthodontic patients A blind randomized clinical trial. Angle Orthodontist. 2014;84(5):896-901.	Excluded by abstract
398	Melo MAS, Morais WA, Passos VF, Lima JPM, Rodrigues LKA. Fluoride releasing and enamel demineralization around orthodontic brackets by fluoride-releasing composite containing nanoparticles. Clinical Oral Investigations. 2014;18(4):1343-50.	Excluded by abstract
399	Paschos E, Geiger FJ, Malyk Y, Rudzki I, Wichelhaus A, Ilie N. Efficacy of four preventive measures against enamel demineralization at the bracket periphery-comparison of microhardness and confocal laser microscopy analysis. Clinical Oral Investigations. 2016;20(6):1355-66.	Excluded by abstract
400	Pliska BT, Warner GA, Tantbirojn D, Larson BE. Treatment of white spot lesions with ACP paste and microabrasion. Angle Orthodontist. 2012;82(5):765-9.	Excluded by abstract
401	Schatzle M, Golland L, Patcas R, Ronay V, Sener B, Attin T, et al. Cleaning Efficacy of Manual Toothbrushes Around Brackets - A Pilot Randomised Control Trial. Oral Health & Preventive Dentistry. 2017;15(1):33-9.	Excluded by abstract
402	van Gastel J, Quirynen M, Teughels W, Coucke W, Carels C. Influence of bracket design on microbial and periodontal parameters in vivo. Journal of Clinical Periodontology. 2007;34(5):423-31.	Excluded by abstract
403	Wagner L, Szepietowska M. Fluoride penetration from three orthodontic adhesives: an experimental study. Korean Journal of Orthodontics. 2013;43(1):29-34.	Excluded by abstract
404	Wen X, Zhang L, Liu R, Deng M, Wang Y, Liu L, et al. Effects of Pulsed Nd:YAG Laser on Tensile Bond Strength and Caries Resistance of Human Enamel. Operative Dentistry. 2014;39(3):273-82.	Excluded by abstract
405	Yap J, Walsh LJ, Naser-ud Din S, Ngo H, Manton DJ. Evaluation of a novel approach in the prevention of white spot lesions around orthodontic brackets. Australian Dental Journal. 2014;59(1):70-80.	Excluded by abstract
406	Yetkiner E, Ozcan M, Wegehaupt FJ, Wiegand A, Eden E, Attin T. Effect of a Low-viscosity Adhesive Resin on the Adhesion of Metal Brackets to Enamel Etched with Hydrochloric or Phosphoric Acid Combined with Conventional Adhesives. Journal of Adhesive Dentistry. 2013;15(6):575-81.	Excluded by abstract
407	Expósito Martín I, Cuan Corrales M, Estrada Verdeja V, Martín Zaldívar L. Factores de riesgo a caries en pacientes con aparatos ortodónticos fijos. Arch méd Camaguey. 2010;14(5).	Excluded by abstract
408	Gonçalves TMSV, Carneiro de Lucena S, Sánchez Ayala A, Rizzatti Barbosa CM. Eficacia del proceso adhesivo en dentina escerótica: revisión de literatura. Acta Odontol Venez. 2011;49(2).	Excluded by abstract
409	Luján Hernández E, Luján Hernández M, Sexto Delgado N. Factores de riesgo de caries dental en niños. Medisur. 2007;5(2).	Excluded by abstract
410	Zúñiga García D, Pastén Castro EJ, Araya-Díaz PA, Palomino Montenegro H. Evaluación de la eficacia de dos prescripciones de cepillos dentales en la remoción de placa bacteriana en pacientes ortodóncicos. Rev clín periodoncia implantol rehabil oral (Impr). 2012;5(3):114-6.	Excluded by abstract
411	Alkan O, Coven BO, Ozcopur B, Kazanci F, Kaya Y, Aydogan C, et al. Effects of Ozone and Prophylactic Antimicrobial Applications on Shear Bond Strength of Orthodontic Brackets. Turk J Orthod. 2017;30(4):101-5.	Excluded by abstract
412	Al-Khateeb S, Forsberg CM, de Jong ED, Angmar-Mansson B. A longitudinal laser fluorescence study of white spot lesions in orthodontic patients. Am J Orthod Dentofacial Orthop 1998;113(6):595-602.	Excluded by abstract
413	Alsayed EZ, Hariri I, Sadr A, Nakashima S, Bakhsh TA, Shimada Y, et al. Optical coherence tomography for evaluation of enamel and protective coatings. Dental Materials Journal. 2015;34(1):98-107.	Excluded by abstract
414	Al-Suleiman M, Silikas N, Watts D. Effects of procedures of remineralization around orthodontics bracket bonded by self-etching primer on its shear bond strength. J Orthod Sci. 2012;1(3):63-8.	Excluded by abstract
415	Alwi NBH, Creanor SL. The influence of fluoride-releasing composites on the development of white-spot lesions near orthodontic brackets: an in vivo investigation. British journal of orthodontics. 1994;21(1):118.	Excluded by abstract
416	Anderson AM, Kao E, Gladwin M, Benli O, Ngan P. The effects of argon laser irradiation on enamel decalcification: an in vivo study. Am J Orthod Dentofacial Orthop 2002;122(3):251-9.	Excluded by abstract
417	Anderson AM. The effectiveness of argon laser irradiation of pumiced and etched enamel on decalcification during orthodontic treatment: an in vivo study. Am J Orthod Dentofacial Orthop 2001;120(6):682.	Excluded by abstract
418	Andersson A, Sköld-Larsson K, Hallgren A, Petersson LG, Twetman S. Effect of a dental cream containing amorphous calcium phosphate complexes on white spot lesion regression assessed by laser fluorescence. Oral Health and Preventive Dentistry. 2007;5(3):229-33.	Excluded by abstract
419	Argueta-Figueroa L, Scougall-Vilchis RJ, Morales-Luckie RA, Olea-Mejia OF. An evaluation of the antibacterial properties and shear bond strength of copper nanoparticles as a nanofiller in orthodontic adhesive. Australian Orthodontic Journal. 2015;31(1):42-8.	Excluded by abstract
420	Attin R, Yetkiner E, Aykut-Yetkiner A, Knosel M, Attint T. Effect of chlorhexidine varnish application on Streptococcus mutans colonisation in adolescents with fixed orthodontic appliances. Australian Orthodontic Journal. 2013;29(1):52-7.	Excluded by abstract
421	Benson PE, Pender N, Higham SM. Quantifying enamel demineralization from teeth with orthodontic brackets - A comparison of two methods. Part 2: Validity. Eur J Orthod 2003;25(2):159-65.	Excluded by abstract
422	Bishara SE, Soliman M, Laffoon JF, Warren J. Shear bond strength of a new high fluoride release glass Ionomer adhesive. Angle Orthodontist. 2008;78(1):125-8.	Excluded by abstract
423	Bishara SE, Swift EJ, Chan DCN. Evaluation of Fluoride Release from an Orthodontic Bonding System. Am J Orthod Dentofacial Orthop 1991;100(2):106-9.	Excluded by abstract
424	Boyd RL. Long-term evaluation of a SnF2 gel for control of gingivitis and decalcification in adolescent orthodontic patients. International dental journal. 1994;44(1 Suppl 1):119-30.	Excluded by abstract
425	Brar GS, Arora AS, Khinda VIS, Kallar S, Arora K. Topographic assessment of human enamel surface treated with different topical sodium fluoride agents: Scanning electron microscope consideration. Indian J Dent Res. 2017;28(6):617-22.	Excluded by abstract
426	Bulut H, Turkun M, Turkun LS, Isiksal E. Evaluation of the shear bond strength of 3 curing bracket bonding systems combined with an antibacterial adhesive. Am J Orthod Dentofacial Orthop 2007;132(1):77-83.	Excluded by abstract
427	Cal-Neto JP, Miguel JAM. Scanning electron microscopy evaluation of the bonding mechanism of a self-etching primer on enamel. Angle Orthodontist. 2006;76(1):132-6.	Excluded by abstract
428	Campos MIC, Campos CN, Aarestrup FM, Fraga MR, Vitral RWF. Estudo Microscópico da Prevenção da Desmineralização do Esmalte Dentário Durante Tratamento Ortodôntico Utilizando Selante de Fóssulas e Fissuras. Pesqui bras odontopediatria clín integr. 2011;11(03).	Excluded by abstract
429	Canbek K, Karbach M, Gottschalk F, Erbe C, Wehrbein H. Evaluation of bovine and human teeth exposed to thermocycling for microleakage under bonded metal brackets. J Orofac Orthop 2013;74(2):102-12.	Excluded by abstract
430	Carvalho C, Fernandes FP, Freitas VdP, FranÇA FMG, Basting RT, Turssi CP, et al. Effect of green tea extract on bonding durability of an etch-and-rinse adhesive system to caries-affected dentin. J appl oral sci. 2016;24(3):211-7.	Excluded by abstract
431	Chaussain C, Vital SO, Viallon V, Vermelin L, Haignere C, Sixou M, et al. Interest in a new test for caries risk in adolescents undergoing orthodontic treatment. Clinical Oral Investigations. 2010;14(2):177-85.	Excluded by abstract
432	Chicri RO. Avaliação da resistência de união de braquetes colados com um cimento de ionômero de vidro modificado por resina, comparando-se diferentes tratamentos prévios no esmalte. 2009:57-.	Excluded by abstract
433	Cooper AM, O'Malley LA, Elison SN, Armstrong R, Burnside G, Adair P, et al. Primary school-based behavioural interventions for preventing caries. Cochrane Database Syst Rev 2013(5).	Excluded by abstract
434	Damle SG, Bector A, Damle D, Kaur S. Effect of dentifrices on their remineralizing potential in artificial carious lesions: An in situ study. Dent Res J (Isfahan). 2016;13(1):74-9.	Excluded by abstract
435	de Souza-e-Silva CM, Parisotto TM, Steiner-Oliveira C, Kamiya RU, Rodrigues LK, Nobre-dos-Santos M. Carbon dioxide laser and bonding materials reduce enamel demineralization around orthodontic brackets. Lasers Med Sci. 2013;28(1):111-8.	Excluded by abstract
436	Dinçer B, Hazar S, Sen BH. Scanning electron microscope study of the effects of soft drinks on etched and sealed enamel. Am J Orthod Dentofacial Orthop 2002;122(2):135-41.	Excluded by abstract

437	Dyer JR, Shannon IL. MFP versus stannous fluoride mouthrinses for prevention of decalcification in orthodontic patients. ASDC journal of dentistry for children. 1982;49(1):19-21.	Excluded by abstract
438	Farhadian N, Rezaei-Soufi L, Jamalian SF, Farhadian M, Tamasoki S, Malekshoar M, et al. Effect of CPP-ACP paste with and without CO2 laser irradiation on demineralized enamel microhardness and bracket shear bond strength. Dental Press J Orthod. 2017;22(4):53-60.	Excluded by abstract
439	Fernandes MLdMF, Moura FMP, Gamaliel KS, Corrêa-Faria P. Cárie dentária e necessidade de tratamento ortodôntico: impacto na qualidade de vida de escolares. Pesqui bras odontopediatria clín integr. 2013;13(1).	Excluded by abstract
440	Fleming PS, Fedorowicz Z, Johal A, El-Angbawi A, Pandis N. Surgical adjunctive procedures for accelerating orthodontic treatment. Cochrane Database Syst Rev 2015(6).	Excluded by abstract
441	Fu H, Liang R, Xiao Y, Zhang XJ. [Efficacy of Tooth Mousse in reducing enamel demineralization and promoting remineralization]. Hua Xi Kou Qiang Yi Xue Za Zhi. 2008;26(3):301-5.	Excluded by abstract
442	Glatz EGM, Featherstone JDB. Demineraliation related to orthodontic bands and brackets - a clinical study. American journal of orthodontics. 1985;87(1):87.	Excluded by abstract
443	GonÇAlves RS, Silva NMd, Watanabe MU, Shinohara MS. Effect of thermocycling to adhesive interface of enamel analyzed by polarized light microscopy. Braz dent sci. 2016;19(4):98-109.	Excluded by abstract
444	Grippaudo C, Cancellieri D, Grecolini ME, Deli R. Comparison between different interdental stripping methods and evaluation of abrasive strips: SEM analysis. Progress in Orthodontics. 2010;11(2):127-37.	Excluded by abstract
445	Guglielmi CdAB. Efeito de materiais restauradores em contato proximal com lesões de cárie em dentes decíduos. 2013:74-.	Excluded by abstract
446	Hallett KB, O'Rourke PK. Baseline dental plaque activity, mutans streptococci culture, and future caries experience in children. Pediatric Dentistry. 2013;35(7):523-8.	Excluded by abstract
447	Harazaki M, Hayakawa K, Fukui T, Isshiki Y, Powell LG. The Nd-YAG laser is useful in prevention of dental caries during orthodontic treatment. Bulletin of Tokyo Dental College. 2001;42(2):79-86.	Excluded by abstract
448	Kashani M, Farhadi S, Rastegarfard N. Comparison of the effect of three cements on prevention of enamel demineralization adjacent to orthodontic bands. J Dent Res Dent Clin Dent Prospects. 2012;6(3):89-93.	Excluded by abstract
449	Kaur T, Tripathi T, Rai P, Kanase A. SEM evaluation of enamel surface changes and enamel microhardness around orthodontic brackets after application of CO2 laser, Er,Cr:YSGG laser and fluoride varnish: An in vivo study. Journal of Clinical and Diagnostic Research. 2017;11(9):ZC59-ZC63.	Excluded by abstract
450	Khan R, Antony VV. Evaluation of the efficacy of fluoride varnish on enamel demineralization in orthodontic patients: a split-mouth clinical trial. Journal of medical sciences (faisalabad). 2013;13(2):146-50.	Excluded by abstract
451	Kim SS, Park WK, Son WS, Ahn HS, Ro JH, Kim YD. Enamel surface evaluation after removal of orthodontic composite remnants by intraoral sandblasting: A 3-dimensional surface profilometry study. Am J Orthod Dentofacial Orthop 2007;132(1):71-6.	Excluded by abstract
452	Komori A, Ishikawa H. Evaluation of a resin-reinforced glass ionomer cement for use as an orthodontic bonding agent. Angle Orthodontist. 1997;67(3):189-96.	Excluded by abstract
453	Machicek SL, McGrory KR, English JD, Stephens CR, Ellis RK, Colville CD, et al. Shear bond strengths of a selenium containing and a conventional light cured adhesive for orthodontic bonding. Tex Dent J. 2011;128(12):1261-7.	Excluded by abstract
454	Macías Gil R, Macías Calás C, Quesada Oliva L, Paneque Gamboa M. Características de la oclusión en niñas y niños malienses, cubanos y venezolanos de 5 a 9 años: estudio descriptivo. Medwave. 2014;14(4).	Excluded by abstract
455	Mahmoudzadeh M, Rezaei-Soufi L, Farhadian N, Jamalian SF, Akbarzadeh M, Momeni M, et al. Effect of CO2 Laser and Fluoride Varnish Application on Microhardness of Enamel Surface Around Orthodontic Brackets. J Lasers Med Sci. 2018;9(1):43-9.	Excluded by abstract
456	Matalon S, Slutzky H, Weiss EI. Antibacterial properties of 4 orthodontic cements. Am J Orthod Dentofacial Orthop 2005;127(1):56-63.	Excluded by abstract
457	Mattousch TJH, van der Veen MH, Zentner A. Caries lesions after orthodontic treatment followed by quantitative light-induced fluorescence: a 2-year follow-up. Eur J Orthod 2007;29(3):294-8.	Excluded by abstract
458	Maxfield BJ, Hamdan AM, Tufekci E, Shroff B, Best AM, Lindauer SJ. Development of white spot lesions during orthodontic treatment: Perceptions of patients, parents, orthodontists, and general dentists. Am J Orthod Dentofacial Orthop 2012;141(3):337-44.	Excluded by abstract
459	Mei L, Chieng J, Wong C, Benic G, Farella M. Factors affecting dental biofilm in patients wearing fixed orthodontic appliances. Progress in Orthodontics. 2017;18(1).	Excluded by abstract
460	Metin-Gursoy G, Taner L, Akca G. Nanosilver coated orthodontic brackets: in vivo antibacterial properties and ion release. Eur J Orthod 2017;39(1):9-16.	Excluded by abstract
461	Metz MJ, Cochran MA, Matis BA, Gonzalez C, Platt JA, Lund MR. Clinical evaluation of 15% carbamide peroxide on the surface microhardness and shear bond strength of human enamel. Operative Dentistry. 2007;32(5):427-36.	Excluded by abstract
462	Mews L, Kern M, Ciesielski R, Fischer-Brandies H, Koos B. Shear bond strength of orthodontic brackets to enamel after application of a caries infiltrant. Angle Orthod. 2015;85(4):645-50.	Excluded by abstract
463	Miresmaeili A, Farhadian N, Rezaei-Soufi L, Saharkhizan M, Veisi M. Effect of carbon dioxide laser irradiation on enamel surface microhardness around orthodontic brackets. Am J Orthod Dentofacial Orthop 2014;146(2):161-5.	Excluded by abstract
464	Mistakidis I, Katib H, Vasilakos G, Kloukos D, Gkantidis N. Clinical outcomes of lingual orthodontic treatment: A systematic review. Eur J Orthod 2016;38(5):447-58.	Excluded by abstract
465	Miwa H, Miyazawa K, Goto S, Kondo T, Hasegawa A. A resin veneer for enamel protection during orthodontic treatment. Eur J Orthod 2001;23(6):759-67.	Excluded by abstract
466	Msallam FA, Grawish MEA, Hafez AM, Abdelnaby YL. Decalcification prevention around orthodontic brackets bonded to bleached enamel using different topical agents. Progress in Orthodontics. 2017;18(1).	Excluded by abstract
467	Ogaard B, Arends J, Helseth H, Dijkman G, vanderKuijl M. Fluoride level in saliva after bonding orthodontic brackets with a fluoride containing adhesive. Am J Orthod Dentofacial Orthop 1997;111(2):199-202.	Excluded by abstract
468	Ogaard B, Duschner H, Ruben J, Arends J. Microradiography and confocal laser scanning microscopy applied to enamel lesions formed in vivo with and without fluoride varnish treatment. European journal of oral sciences. 1996;104(4 (Pt 1)):378-83.	Excluded by abstract
469	Paschos E, Rosenbeck KA, Huth KC, Rudzki I, Wichelhaus A, Kunzelmann KH. Evaluation of the effect of bracket-periphery treatment on prevention of enamel demineralization by consecutive mu CT scans. Clinical Oral Investigations. 2015;19(6):1519-26.	Excluded by abstract
470	Passalini P, Fidalgo TK, Caldeira EM, Gleiser R, Nojima Mda C, Maia LC. Mechanical properties of one and two-step fluoridated orthodontic resins submitted to different pH cycling regimes. Braz Oral Res. 2010;24(2):197-203.	Excluded by abstract
471	Pithon MM, dos Santos MJ, Andrade CSS, Leao JCB, Braz AKS, de Araujo RE, et al. Effectiveness of varnish with CPP-ACP in prevention of caries lesions around orthodontic brackets: an OCT evaluation. Eur J Orthod 2015;37(2):177-82.	Excluded by abstract
472	Pseiner BC, Freudenthaler J, Jonke E, Bantleon HP. Shear bond strength of fluoride-releasing orthodontic bonding and composite materials. Eur J Orthod. 2010;32(3):268-73.	Excluded by abstract
473	Raji SH, Banimostafaee H, Hajizadeh F. Effects of fluoride release from orthodontic bonding materials on nanomechanical properties of the enamel around orthodontic brackets. Dent Res J (Isfahan). 2014;11(1):67-73.	Excluded by abstract
474	Rezklega F, Ogaard B, Arends J. An Invivo Study on the Merits of 2 Glass Ionomers for the Cementation of Orthodontic Bands. Am J Orthod Dentofacial Orthop 1991;99(2):162-7.	Excluded by abstract
475	Ribeiro JLdO, Bezerra RB, Campos EdJ, Freitas AAd. Avaliação da resistência adesiva e do padrão de descolagem de diferentes sistemas de colagem de braquetes associados à clorexidina. Rev Dent Press Ortod Ortop Facial (Impr). 2008;13(4):117-26.	Excluded by abstract
476	Rix D, Foley TF, Banting D, Mamandras A. A comparison of fluoride release by resin-modified GIC and polyacid-modified composite resin. Am J Orthod Dentofacial Orthop 2001;120(4):398-405.	Excluded by abstract
477	Schmit JL, Staley RN, Wefel JS, Kanellis M, Jakobsen JR, Keenan PJ. Effect of fluoride varnish on demineralization adjacent to brackets bonded with RMGI cement. Am J Orthod Dentofacial Orthop 2002;122(2):125-34.	Excluded by abstract
478	Seifi M, Atri F, Yazdani MM. Effects of low-level laser therapy on orthodontic tooth movement and root resorption after artificial socket preservation. Dent Res J (Isfahan). 2014;11(1):61-6.	Excluded by abstract
479	Shahabi M, Ahrari F, Mohamadipour H, Moosavi H. Microleakage and shear bond strength of orthodontc brackets bonded to hypomineralized enamel following different surface preparations. J Clin Exp Dent. 2014;6(2):e110-5.	Excluded by abstract
480	Shimazu K, Ogata K, Karibe H. Evaluation of the caries-preventive effect of three orthodontic band cements in terms of fluoride release, retentiveness, and microleakage. Dental Materials Journal. 2013;32(3):376-80.	Excluded by abstract
481	Sodagar A, Akhavan A, Hashemi E, Arab S, Pourhajibagher M, Sodagar K, et al. Evaluation of the antibacterial activity of a conventional orthodontic composite containing silver/hydroxyapatite nanoparticles. Progress in Orthodontics. 2016;17(1).	Excluded by abstract
482	Spencer CG, Campbell PM, Buschang PH, Cai J, Honeyman AL. Antimicrobial effects of zinc oxide in an orthodontic bonding agent. Angle Orthod. 2009;79(2):317-22.	Excluded by abstract
483	Steckel SE, Rueggeberg FA, Whitford GM. Effect of resin cure mode and fluoride content on bracket debonding. Angle Orthodontist. 1999;69(3):282-7.	Excluded by abstract
484	Tostes M, Mucha JN, Coutinho TCL, da Silva EM. Evaluation of the effects of the bonding agent on acid-etched human enamel demineralization: in situ study. Eur J Orthod 2013;35(3):369-74.	Excluded by abstract
485	Wilson TG, Love B. Clinical effectiveness of fluoride-releasing elastomers. II. Enamel microhardness levels. Am J Orthod Dentofacial Orthop 1995;107(4):379-81.	Excluded by abstract
486	Wiltshire WA. Determination of fluoride from fluoride-releasing elastomeric ligature ties. Am J Orthod Dentofacial Orthop 1996;110(4):383-7.	Excluded by abstract
487	Yamada N, Miyazawa K, Miwa H, Tabuchi M, Kondo T, Goto S. Application of direct laminate veneer for enamel protection during orthodontic treatment: An in vivo evaluation. Dental Materials Journal. 2005;24(4):603-9.	Excluded by abstract
488	Yassaei S, Aghili H, Shahraki N, Safari I. Efficacy of erbium-doped yttrium aluminum garnet laser with casein phosphopeptide amorphous calcium phosphate with and without fluoride for remineralization of white spot lesions around orthodontic brackets. Eur J Dent. 2018;12(2):210-6.	Excluded by abstract
489	{NCT00268138} Elmex Gel Efficacy in Preventing White Spot Lesions. Unknown status.	Excluded; trial registration*
490	{NCT00670618} A Prospective, Randomized Clinical Study on the Effects of Casein Phosphopeptide-amorphous Calcium Phosphate (CPP-ACP) Paste on Plaque, Gingivitis and White Spot Lesions in Orthodontic Patients - Part 2. Unknown status.	Excluded; trial registration*
491	{NCT00670670} A Prospective, Randomized Clinical Study on the Effects of Casein Phosphopeptide-amorphous Calcium Phosphate (CPP-ACP) Paste on Plaque, Gingivitis and White Spot Lesions in Orthodontic Patients - Part 1. Unknown status.	Excluded; trial registration*
492	{NCT01059058} Study of Treatments Used for White Spot Lesions After Orthodontic Treatment. Completed.	Excluded; trial registration*
493	{NCT01329731} Remineralisation of White Spot Lesions by Elmex® gelée in Post-orthodontic Patients. Completed	Excluded; trial registration*
494	{NCT01344473} A Trial of Tooth Mousse to Remineralise Post-orthodontic Treatment White Spot Lesions. Completed.	Excluded; trial registration*
495	{NCT01500187} Fluoride Varnish for Treatment of White Spot Lesions. Completed.	Excluded; trial registration*
496	{NCT01768390} Caries-preventive Effect of a Dentifrice Containing 5,000 Ppm Fluoride in Orthodontic Patients. Completed.	Excluded; trial registration*
497	{NCT02001311} Effect of Chlorhexidine Gel on Bacterial Count During Fixed Orthodontic Treatment. Unknown status.	Excluded; trial registration*
498	{NCT02400957} Addition of Silver Nanoparticles to a Orthodontic Primer in Preventing Enamel Demineralization Adjacent Brackets. Unknown status.	Excluded; trial registration*
499	{NCT02705456} Enamel Caries in Orthodontic Patients. Completed.	Excluded; trial registration*

500	{NCT02771522} Caries Lesion Activity in Orthodontic Patients - Calcivis System. Recruiting.	Excluded; trial registration*
501	{NCT02913885} Effect of Curodont Repair on Color Change of White Spot Lesions. Not yet recruiting.	Excluded; trial registration*
502	{NCT03004196} Comparison of Efficacy Of Probiotic Toothpaste and Chlorhexidine Mouthwash To Reduce S.Mutans. Completed.	Excluded; trial registration*
503	{NCT03114475} Effect of CO2 Laser on Enamel White Spot Lesion Formation Around Orthodontic Brackets. Active, not recruiting.	Excluded; trial registration*
504	{NCT03187548} Evaluation of CPP-ACP Prophylactic Effect on Enamel Surface During Orthodontic Treatment. Not yet recruiting.	Excluded; trial registration*
505	{NCT03306433} Prevention of Enamel Demineralization by Use of K18-smooth Surface Sealant. Not yet recruiting.	Excluded; trial registration*
506	Dong YN, Chen M, Ren XM. Effect of fluor protector on preventing enamel demineralization. Journal of Clinical Rehabilitative Tissue Engineering Research. 2009;13(25):4997-5000.	Excluded; no fulltext
507	Esenlik E, Celik EU, Bolat E. Efficacy of a casein phosphopeptide amorphous calcium phosphate (CPP-ACP) paste in preventing white spot lesions in patients with fixed orthodontic appliances: A prospective clinical trial. European Journal of Paediatric Dentistry. 2016;17(4):274-80.	Excluded; no fulltext
508	He WD, Liu YZ, Xu YY, Chen D. [Study on application of CPP-ACP on tooth mineralization during orthodontic treatment with fixed appliance]. Shanghai Kou Qiang Yi Xue. 2010;19(2):140-3.	Excluded; no fulltext
509	Shan LH, Cui ZQ, Shen QH, Gao Q, Qiu ZX. Application of light-cure resin-modified glass ionomer cement in orthodontic practice. Journal of Clinical Rehabilitative Tissue Engineering Research. 2008;12(6):1149-52.	Excluded; no fulltext
510	Twetman S, Hallgren A, Petersson LG. Effect of an antibacterial varnish on mutans streptococci in plaque from enamel adjacent to orthodontic appliances. Caries Res. 1995;29(3):188-91.	Excluded; no fulltext
511	Wang M, Guo Y, Jiang H. Effectiveness of topical fluoride on prevention of enamel demineralization during the orthodontic treatment in China: A systematic review. Chinese Journal of Evidence-Based Medicine. 2013;13(7):875-84.	Excluded; no fulltext
512	Boyd RL. Two-year longitudinal study of a peroxide-fluoride rinse on decalcification in adolescent orthodontic patients. Journal of clinical dentistry. 1992;3(3):83-7.	Excluded; no fulltext
513	Fowler PV. A twelve-month clinical trial comparing the bracket failure rates of light-cured resin-modified glass-ionomer adhesive and acid-etch chemical-cured composite. Australian orthodontic journal. 1998;15(3):186-90.	Excluded; no fulltext
514	Georgoudi M, Cook PC, Curzon MEJ. Effect of cement type on enamel demineralization in young orthodontic patients. Caries research. 1991;25(3):232.	Excluded; no fulltext
515	Gorton J, Featherstone JDB. Inhibition of demineralization around orthodontic brackets in vivo by glass ionomer cement. Caries research. 2002;36(3):185.	Excluded; no fulltext
516	Hirschfield RE. Control of decalcification by use of fluoride mouthrinse. ASDC journal of dentistry for children. 1978;45(6):458-60.	Excluded; no fulltext
517	McDonagh S, Ash S. Demineralization associated with precoated and conventional bracket systems. Eur J Orthod 1996;18(5).	Excluded; no fulltext
518	Moopen S, Collins M, Lynch E, Goodvelt M. Enamel demineralisation around orthodontic brackets bonded with an ionomer resin. Eur J Orthod 2000;22(5).	Excluded; no fulltext
519	Ogaard B, Larsson E. Preventive effects in orthodontic patients of a toothpaste / mouthrinse containing amine fluoride / stannous fluoride. Caries research. 2004;38.	Excluded; no fulltext
520	Quaranta A, Marchisio O, D'Isidoro O, Genovesi AM, Covani U. Single-blind randomized clinical trial on the efficacy of an interdental cleaning device in orthodontic patients. Minerva Stomatol. 2018;67(4):141-7.	Excluded; no fulltext
521	Sachse A, Beberhold K, Schwestka-Polly R. Smooth surface sealing and reducing demineralisation in interceptive orthodontia. Deutsche zahnarztliche zeitschrift. 2007;62(11):D18.	Excluded; no fulltext
522	Salzmann JA. A clinical evaluation of decalcification under orthodontic bands following pretreatment with acidulated phosphate-fluorides and adhesive plastic coatings. (Abstract - Department of Orthodontics, School of Dentistry, Case Western Reserve University, Cleveland, Ohio, and Fairleight Dickenson University, Hackensak, NJ, USA). American journal of orthodontics. 1976;69(6):698.	Excluded; no fulltext
523	Shipley TS. The effect of argon laser irradiation on reducing enamel decalcification during orthodontic treatment: an in vitro and an in vivo study. (Abstract). Am J Orthod Dentofacial Orthop 2006;129(1).	Excluded; no fulltext
524	Willmot DR, Benson PE. Size changes of post-orthodontic demineralised white enamel lesions. Journal of dental research. 2001;80(4):1150, Abstract no: 68.	Excluded; no fulltext
525	Scheerman JFM, van Meijel B, van Empelen P, Kramer GJC, Verrips GHW, Pakpour AH, et al. Study protocol of a randomized controlled trial to test the effect of a smartphone application on oral-health behavior and oral hygiene in adolescents with fixed orthodontic appliances. Bmc Oral Health. 2018;18.	Excluded; ongoing study
526	Souza BM, Santos DMS, Braga AS, Santos NMD, Rios D, Buzalaf MAR, et al. Effect of a Titanium Tetrafluoride Varnish in the Prevention and Treatment of Carious Lesions in the Permanent Teeth of Children Living in a Fluoridated Region: Protocol for a Randomized Controlled Trial. JMIR Res Protoc. 2018;7(1):e26.	Excluded; ongoing study
527	Nct. A Prospective, Randomized Clinical Study on the Effects of Casein Phosphopeptide-amorphous Calcium Phosphate (CPP-ACP) Paste on Plaque, Gingivitis and White Spot Lesions in Orthodontic Patients - Part 1. Https://clinicaltrialsgov/show/nct00670670. 2008.	Excluded; ongoing study
528	Nct. A Prospective, Randomized Clinical Study on the Effects of Casein Phosphopeptide-amorphous Calcium Phosphate (CPP-ACP) Paste on Plaque, Gingivitis and White Spot Lesions in Orthodontic Patients - Part 2. Https://clinicaltrialsgov/show/nct00670618. 2008.	Excluded; ongoing study
529	Nct. A Trial of Tooth Mousse to Remineralise Post-orthodontic Treatment White Spot Lesions. Https://clinicaltrialsgov/show/nct01344473. 2011.	Excluded; ongoing study
530	Nct. Addition of Silver Nanoparticles to a Orthodontic Primer in Preventing Enamel Demineralization Adjacent Brackets. Https://clinicaltrialsgov/show/nct02400957. 2015.	Excluded; ongoing study
531	Nct. Comparison of Efficacy Of Probiotic Toothpaste and Chlorhexidine Mouthwash To Reduce S.Mutans. Https://clinicaltrialsgov/show/nct03004196. 2016.	Excluded; ongoing study
532	Nct. Comparison of Three Toothpastes for the Prevention and Reduction of White Spot Lesions. Https://clinicaltrialsgov/show/nct03440996. 2018.	Excluded; ongoing study
533	Nct. Crossbow Versus Forsus Springs in Mild to Moderate Class II Malocclusion Cases. Https://clinicaltrialsgov/show/nct01530516. 2012.	Excluded; ongoing study
534	Nct. De-bonding Following Infiltration. Https://clinicaltrialsgov/show/nct02359318. 2015.	Excluded; ongoing study
535	Nct. Effect of CO2 Laser on Enamel White Spot Lesion Formation Around Orthodontic Brackets. Https://clinicaltrialsgov/show/nct03114475. 2017.	Excluded; ongoing study
536	Nct. Effect of Curodont Repair on Color Change of White Spot Lesions. Https://clinicaltrialsgov/show/nct02913885. 2016.	Excluded; ongoing study
537	Nct. Efficacy of a Plaque Disclosing Toothpaste on Home Oral Hygiene Procedures. Https://clinicaltrialsgov/show/nct03287011. 2017.	Excluded; ongoing study
538	Nct. Efficacy of Minimally Invasive Surgical Technique in Accelerating Orthodontic Treatment. Https://clinicaltrialsgov/show/nct02606331. 2015.	Excluded; ongoing study
539	Nct. Elmex Gel Efficacy in Preventing White Spot Lesions. Https://clinicaltrialsgov/show/nct00268138. 2005.	Excluded; ongoing study
540	Nct. Evaluation of CPP-ACP Prophylactic Effect on Enamel Surface During Orthodontic Treatment. Https://clinicaltrialsgov/show/nct03187548. 2017.	Excluded; ongoing study
541	Nct. Evaluation of Remineralizing Efficacy of Combination Varnishes on White Spot Lesions in ECC Children. Https://clinicaltrialsgov/show/nct03360266. 2017.	Excluded; ongoing study
542	Nct. Fissure Caries Inhibition Study With Solea CO2-9.3µm Short-pulsed Laser. Https://clinicaltrialsgov/show/nct02357979. 2015.	Excluded; ongoing study
543	Nct. Fluoride Varnish for Treatment of White Spot Lesions. Https://clinicaltrialsgov/show/nct01500187. 2011.	Excluded; ongoing study
544	Nct. MI Varnish and MI Paste Plus in a Caries Prevention and Remineralization Study. Https://clinicaltrialsgov/show/nct02424097. 2015.	Excluded; ongoing study
545	Nct. MI Varnish for the Prevention of White Spot Lesions. Https://clinicaltrialsgov/show/nct03446690. 2018.	Excluded; ongoing study
546	Nct. Microbial and Periodontal Changes Associated With Conventional Versus Self Ligating Brackets. Https://clinicaltrialsgov/show/nct02436525. 2015.	Excluded; ongoing study
547	Nct. Microbiological and Epithelial Evaluation Related to the Use of Orthodontic Thermoplastic Device. Https://clinicaltrialsgov/show/nct02427763. 2015.	Excluded; ongoing study
548	Nct. One Year Clinical Evaluation of White Spot Lesions Treated With Newly Introduced Resin Modified Glass Ionomer in Comparison to Resin Infiltration in Anterior Teeth Split Mouth Technique. Https://clinicaltrialsgov/show/nct02912741. 2016.	Excluded; ongoing study
549	Nct. Partial Pulpotomy on Caries Free Human Teeth. Https://clinicaltrialsgov/show/nct01420718. 2011.	Excluded; ongoing study
550	Nct. Prevention of Enamel Demineralization by Use of K18-smooth Surface Sealant. Https://clinicaltrialsgov/show/nct03306433. 2017.	Excluded; ongoing study
551	Nct. Probiotic Lozenge Reduce Streptococcus Mutans in Plaque in Orthodontic Bracket Patients. Https://clinicaltrialsgov/show/nct02357771. 2015.	Excluded; ongoing study
552	Nct. Resin Infiltration and Resin Infiltration With Bleaching in Improving the Esthetics for Fluorosis Stains. Https://clinicaltrialsgov/show/nct01733888. 2012.	Excluded; ongoing study
553	Nct. RMGI v Composite for Orthodontic Bonding. Https://clinicaltrialsgov/show/nct01925924. 2013.	Excluded; ongoing study
554	Nct. Study of Treatments Used for White Spot Lesions After Orthodontic Treatment. Https://clinicaltrialsgov/show/nct01059058. 2010.	Excluded; ongoing study
555	Nct. The Use of Quantitative Light Induced Fluorescence Digital as an Oral Hygiene Evaluation Tool in Orthodontics. Https://clinicaltrialsgov/show/nct02545660. 2015.	Excluded; ongoing study
556	Chong LY, Clarkson JE, Dobbyn-Ross L, Bhakta S. Slow-release fluoride devices for the control of dental decay. Cochrane Database Syst Rev 2018(3).	Excluded; not relevant
557	Flores-Mir C. Bonded molar tubes associated with higher failure rate than molar bands. Evid Based Dent. 2011;12(3):84.	Excluded; not relevant
558	Kalha A. Some evidence that fluoride during orthodontic treatment reduces occurrence and severity of white spot lesions: Is fluoride effective in preventing white spot lesions during orthodontic treatment? Evidence-Based Dentistry. 2004;5(4):98-9.	Excluded; not relevant
559	Kalha AS. Topical fluorides and decalcification around fixed orthodontic appliances: Which topical fluoride preparations are best able to prevent decalcification around fixed orthodontic appliances? Evidence-Based Dentistry. 2006;7(2):38-9.	Excluded; not relevant
560	Marinho VCC, Chong LY, Worthington HV, Walsh T. Fluoride mouthrinses for preventing dental caries in children and adolescents. Cochrane Database Syst Rev 2016(7).	Excluded; not relevant
561	Marinho VCC, Higgins J, Logan S, Sheiham A. Fluoride toothpastes for preventing dental caries in children and adolescents. Cochrane Database Syst Rev 2003(1).	Excluded; not relevant
562	Marinho VCC, Worthington HV, Walsh T, Chong LY. Fluoride gels for preventing dental caries in children and adolescents. Cochrane Database Syst Rev 2015(6).	Excluded; not relevant
563	Marinho VCC, Worthington HV, Walsh T, Clarkson JE. Fluoride varnishes for preventing dental caries in children and adolescents. Cochrane Database Syst Rev 2013(7).	Excluded; not relevant
564	Martinez-Mier EA. Fluoride Varnish Applications May Reduce the Formation of White Spot Lesions (WSL) Adjacent to Orthodontic Fixed Appliances. Journal of Evidence-Based Dental Practice. 2009;9(1):16-7.	Excluded; not relevant
565	Martinez-Mier EA. Fluoride-containing orthodontic adhesives may reduce the occurrence of enamel demineralization in patients with fixed orthodontic appliances. Journal of Evidence-Based Dental Practice. 2011;11(3):132-4.	Excluded; not relevant
566	Miles P. Accelerated orthodontic treatment - what's the evidence? Australian Dental Journal. 2017;62:63-70.	Excluded; not relevant
567	O'Neill J. Little evidence exists about optimal caries-prevention strategies during orthodontic treatment: What is the most effective method of preventing white spot lesions during orthodontic treatment? Evidence-Based Dentistry. 2004;5(4):97.	Excluded; not relevant
568	Patcas R, Eliades T. Enamel alterations due to orthodontic treatment. Orthodontic Applications of Biomaterials: A Clinical Guide. Woodhead Publishing Series in Biomaterials2017. p. 221-39.	Excluded; not relevant
569	Rollings S, Greene L, Borrie F, Lamont T. Small trial finds beneficial effect for MI Paste in preventing white spot lesions during orthodontic treatment. Evid Based Dent. 2012;13(4):117-8.	Excluded; not relevant
570	Shafi I. Fluoride varnish reduces white spot lesions during orthodontic treatment. Evid Based Dent. 2008;9(3):81.	Excluded; not relevant
571	Stafford GL. Fluoride varnish may improve white spot lesions. Evid Based Dent. 2011;12(4):104-5.	Excluded; not relevant
572	Wishney M. Potential risks of orthodontic therapy: a critical review and conceptual framework. Australian Dental Journal. 2017;62:86-96.	Excluded; not relevant
573	Stampfl M, Nguyen E. Etiology of White Spot Lesions During an Orthodontic Treatment. Informationen Aus Orthodontie Und Kieferorthopaedie. 2017;49(1):69-71.	Excluded; not in vivo
574	Attin R. Caries Prevention in Orthodontics. Informationen Aus Orthodontie Und Kieferorthopaedie. 2016;48(2):121-6.	Excluded; not in vivo
575	Cury JA, de Oliveira BH, dos Santos APP, Tenuta LMA. Are fluoride releasing dental materials clinically effective on caries control? Dental Materials. 2016;32(3):323-33.	Excluded; not in vivo
576	Hani TB, O'Connell AC, Duane B. Casein phosphopeptide-amorphous calcium phosphate products in caries prevention. Evid Based Dent. 2016;17(2):46-7.	Excluded; not in vivo
577	Heymann GC, Grauer D. A Contemporary Review of White Spot Lesions in Orthodontics. Journal of Esthetic and Restorative Dentistry. 2013;25(2):85-95.	Excluded; not in vivo
578	Khoroushi M, Kachuie M. Prevention and Treatment of White Spot Lesions in Orthodontic Patients. Contemporary Clinical Dentistry. 2017;8(1):11-9.	Excluded; not in vivo
579	Miller MJ, Bernstein S, Colaiacovo SL, Nicolay O, Cisneros GJ. Demineralized white spot lesions: An unmet challenge for orthodontists. Seminars in Orthodontics. 2016;22(3):193-204.	Excluded; not in vivo

580	Oosterkamp BCM, van der Sanden WJM, Frencken J, Kuijpers-Jagtman AM. Caries Preventive Measures in Orthodontic Practice: The Development of a Clinical Practice Guideline. Informationen Aus Orthodontie Und Kieferorthopaedie. 2017;49(2):122-31.	Excluded; not in vivo
581	Benson P. Evaluation of White Spot Lesions on Teeth with Orthodontic Brackets. Seminars in Orthodontics. 2008;14(3):200-8.	Excluded; not in vivo
582	Benson PE. Fluoride-containing materials and the prevention of demineralization during orthodontic treatment-which research method should we now use? Seminars in Orthodontics. 2010;16(4):293-301.	Excluded; not in vivo
583	Staley RN. Effect of Fluoride Varnish on Demineralization Around Orthodontic Brackets. Seminars in Orthodontics. 2008;14(3):194-9.	Excluded; not in vivo
584	Willmot D. White Spot Lesions After Orthodontic Treatment. Seminars in Orthodontics. 2008;14(3):209-19.	Excluded; not in vivo
585	Benson PE, Parkin N, Dyer F, Millett DT, Furness S, Germain P. Fluorides for the prevention of early tooth decay (demineralised white lesions) during fixed brace treatment. Cochrane Database Syst Rev. 2013(12):Cd003809.	Excluded; systematic review
586	Filho CF, Lima KC. Eficacia del uso tópico de fluoruros y del cepillado en el control de caries producidas "in vivo": revisión sistemática. Av Odontoestomatol. 2008;24(4):277-88.	Excluded; systematic review
587	Fleming PS, Johal A, Pandis N. Self-etch primers and conventional acid-etch technique for orthodontic bonding: a systematic review and meta-analysis. Am J Orthod Dentofacial Orthop. 2012;142(1):83-94.	Excluded; systematic review
588	Goh HH. Interspace/interdental brushes for oral hygiene in orthodontic patients with fixed appliances. Cochrane Database Syst Rev. 2007(3):Cd005410.	Excluded; systematic review
589	Gurunathan D, Somasundaram S. Prevention of white spot lesion in orthodontic patients using casein phosphopeptide-stabilized amorphous calcium phosphate -a systematic review. International Journal of Pharma and Bio Sciences. 2015;6(2):B702-B6.	Excluded; systematic review
590	Hu H, Li C, Li F, Chen J, Sun J, Zou S, et al. Enamel etching for bonding fixed orthodontic braces. Cochrane Database Syst Rev. 2013(11):Cd005516.	Excluded; systematic review
591	Li J, Xie X, Wang Y, Yin W, Antoun JS, Farella M, et al. Long-term remineralizing effect of casein phosphopeptide-amorphous calcium phosphate (CPP-ACP) on early caries lesions in vivo: a systematic review. J Dent. 2014;42(7):769-77.	Excluded; systematic review
592	Mandall NA, Millett DT, Mattick CR, Hickman J, Macfarlane TV, Worthington HV. Adhesives for fixed orthodontic brackets. Cochrane Database Syst Rev. 2003(2):Cd002282.	Excluded; systematic review
593	Mandall NA, Millett DT, Mattick CR, Hickman J, Worthington HV, Macfarlane TV. Orthodontic adhesives: a systematic review. J Orthod. 2002;29(3):205-10; discussion 195.	Excluded; systematic review
594	Marinho VC. Cochrane reviews of randomized trials of fluoride therapies for preventing dental caries. Eur Arch Paediatr Dent. 2009;10(3):183-91.	Excluded; systematic review
595	Oosterkamp BC, Wafae A, Schols JG, van der Sanden WJ, Wensing M. Effectiveness of a clinical guideline to improve dental health among orthodontically treated patients: study protocol for a cluster randomized controlled trial. Trials. 2016;17(1):201.	Excluded; systematic review
596	Migliorati M, Isaia L, Cassaro A, Rivetti A, Silvestrini-Biavati F, Gastaldo L, et al. Efficacy of professional hygiene and prophylaxis on preventing plaque increase in orthodontic patients with multibracket appliances: a systematic review. Eur J Orthod. 2015;37(3):297-307.	Excluded; systematic review
597	Millett DT, Mandall NA, Mattick RC, Hickman J, Glenny AM. Adhesives for bonded molar tubes during fixed brace treatment. Cochrane Database Syst Rev. 2017;2:Cd008236.	Excluded; systematic review
598	Nascimento PL, Fernandes MT, Figueiredo FE, Faria ESAL. Fluoride-Releasing Materials to Prevent White Spot Lesions around Orthodontic Brackets: A Systematic Review. Braz Dent J. 2016;27(1):101-7.	Excluded; systematic review
599	Paula ABP, Fernandes AR, Coelho AS, Marto CM, Ferreira MM, Caramelo F, et al. Therapies for White Spot Lesions-a Systematic Review. Journal of Evidence-Based Dental Practice. 2017;17(1):23-38.	Excluded; systematic review
600	Benson PE, Parkin N, Millett DT, Dyer FE, Vine S, Shah A. Fluorides for the prevention of white spots on teeth during fixed brace treatment. Cochrane Database Syst Rev. 2004(3):Cd003809.	Excluded; systematic review
601	Raphael S, Blinkhorn A. Is there a place for Tooth Mousse in the prevention and treatment of early dental caries? A systematic review. BMC Oral Health. 2015;15(1):113.	Excluded; systematic review
602	Rogers S, Chadwick B, Treasure E. Fluoride-containing orthodontic adhesives and decalcification in patients with fixed appliances: a systematic review. Am J Orthod Dentofacial Orthop. 2010;138(4):390.e1-8; discussion -1.	Excluded; systematic review
603	Seehra J, Pandis N, Fleming PS. Clinical evaluation of marketed orthodontic products: are researchers behind the times? A meta-epidemiological study. Progress in Orthodontics. 2017;18(1).	Excluded; systematic review
604	Sonesson M, Bergstrand F, Gizani S, Twetman S. Management of post-orthodontic white spot lesions: an updated systematic review. Eur J Orthod 2017;39(2):116-21.	Excluded; systematic review
605	Benson PE, Shah AA, Millett DT, Dyer F, Parkin N, Vine RS. Fluorides, orthodontics and demineralization: A systematic review. Journal of Orthodontics. 2005;32(2):102-14.	Excluded; systematic review
606	Bergstrand F, Twetman S. A review on prevention and treatment of post-orthodontic white spot lesions - evidence-based methods and emerging technologies. Open Dentistry Journal. 2011;5(1):158-62.	Excluded; systematic review
607	de Almeida CM, da Rosa WLO, Meereis CTW, de Almeida SM, Ribeiro JS, da Silva AF, et al. Efficacy of antimicrobial agents incorporated in orthodontic bonding systems: a systematic review and meta-analysis. Journal of Orthodontics. 2018;45(2):79-93.	Excluded; systematic review
608	Derks A, Katsaros C, Frencken JE, Van't Hof MA, Kuijpers-Jagtman AM. Caries-inhibiting effect of preventive measures during orthodontic treatment with fixed appliances: A systematic review. Caries Research. 2004;38(5):413-20.	Excluded; systematic review
609	Lima IFP, De Andrade Vieira W, De Macedo Bernardino I, Costa PA, Lima APB, Pithon MM, et al. Influence of reminder therapy for controlling bacterial plaque in patients undergoing orthodontic treatment: A systematic review and meta-analysis. Angle Orthodontist. 2018;88(4):483-93.	Excluded; systematic review
610	Lopatiene K, Borisovaite M, Lapenaite E. Prevention and Treatment of White Spot Lesions During and After Treatment with Fixed Orthodontic Appliances: a Systematic Literature Review. J Oral Maxillofac Res. 2016;7(2):e1.	Excluded; systematic review
611	Millett DT, Glenny AM, Mattick RCR, Hickman J, Mandall NA. Adhesives for fixed orthodontic bands. Cochrane Database Syst Rev 2016(10).	Excluded; systematic review
612	Mohammed H, Rizk MZ, Wafaie K, Ulhaq A, Almuzian M. Reminders improve oral hygiene and adherence to appointments in orthodontic patients: a systematic review and meta-analysis. Eur J Orthod. 2018.	Excluded; systematic review
613	Sundararaj D, Venkatachalapathy S, Tandon A, Pereira A. Critical evaluation of incidence and prevalence of white spot lesions during fixed orthodontic appliance treatment: A meta-analysis. Journal of International Society of Preventive and Community Dentistry. 2015;5(6):433-9.	Excluded; systematic review
614	Azeem M, Ul Hamid W. Incidence of white spot lesions during orthodontic clear aligner therapy. Journal of the World Federation of Orthodontists. 2017;6(3):127-30.	Excluded; no orthodontic treatment
615	Yagci A, Korkmaz YN, Buyuk SK, Yagci F, Atilla AO. White spot lesion formation after treatment with full-coverage rapid maxillary expanders. Am J Orthod Dentofacial Orthop 2016;149(3):331-8.	Excluded; no orthodontic treatment
616	Chung CK, Millett DT, Creanor SL, Gilmour WH, Foye RH. Fluoride release and cariostatic ability of a compomer and a resin-modified glass ionomer cement used for orthodontic bonding. J Dent. 1998;26(5-6):533-8.	Excluded; partial appliances
617	Mehta A, Paramshivam G, Chugh VK, Singh S, Halkai S, Kumar S. Effect of light-curable fluoride varnish on enamel demineralization adjacent to orthodontic brackets: an in-vivo study. Am J Orthod Dentofacial Orthop. 2015;148(5):814-20.	Excluded; partial appliances
618	O'Reilly MM, Featherstone JD. Demineralization and remineralization around orthodontic appliances: an in vivo study. Am J Orthod Dentofacial Orthop. 1987;92(1):33-40.	Excluded; partial appliances
619	Nee A, Chan K, Kang H, Staninec M, Darling CL, Fried D. Longitudinal monitoring of demineralization peripheral to orthodontic brackets using cross polarization optical coherence tomography. J Dent. 2014;42(5):547-55.	Excluded; partial appliances
620	Tufekci E, Pennella DR, Mitchell JC, Best AM, Lindauer SJ. Efficacy of a fluoride-releasing orthodontic primer in reducing demineralization around brackets: an in-vivo study. Am J Orthod Dentofacial Orthop. 2014;146(2):207-14.	Excluded; partial appliances
621	Uysal T, Akkurt MD, Amasyali M, Ozcan S, Yagci A, Basak F, et al. Does a chitosan-containing dentifrice prevent demineralization around orthodontic brackets? Angle Orthod. 2011;81(2):319-25.	Excluded; partial appliances
622	Uysal T, Amasyali M, Koyuturk AE, Ozcan S. Effects of different topical agents on enamel demineralization around orthodontic brackets: an in vivo and in vitro study. Aust Dent J. 2010;55(3):268-74.	Excluded; partial appliances
623	Uysal T, Amasyali M, Ozcan S, Koyuturk AE, Akyol M, Sagdic D. In vivo effects of amorphous calcium phosphate-containing orthodontic composite on enamel demineralization around orthodontic brackets. Aust Dent J. 2010;55(3):285-91.	Excluded; partial appliances
624	Uysal T, Amasyali M, Ozcan S, Koyuturk AE, Sagdic D. Effect of antibacterial monomer-containing adhesive on enamel demineralization around orthodontic brackets: an in-vivo study. Am J Orthod Dentofacial Orthop. 2011;139(5):650-6.	Excluded; partial appliances
625	Yagci A, Korkmaz YN, Yagci F, Atilla AO, Buyuk SK. Effect of 3 cements on white spot lesion formation after full-coverage rapid maxillary expander: A comparative in-vivo study. Am J Orthod Dentofacial Orthop. 2016;150(6):1005-13.	Excluded; partial appliances
626	Dimitriadis AG, Sassouni V, Draus FJ. The effects of topical fluoride applications underneath loose orthodontic bands. Angle Orthodontist. 1974;44(1):94-9.	Excluded; partial appliances
627	Gorton J, Featherstone JDB. In vivo inhibition of derainerализation around orthodontic brackets. Am J Orthod Dentofacial Orthop 2003;123(1):10-4.	Excluded; partial appliances
628	Oz AZ, Oz AA, Yazicioglu S. In vivo effect of antibacterial and fluoride-releasing adhesives on enamel demineralization around brackets: A micro-CT study. Angle Orthod. 2017;87(6):841-6.	Excluded; partial appliances
629	Tinsley D, O'Dwyer JJ, Benson PE. Scientific section: Fluoridated elastomers: In vivo versus in vitro fluoride release. Journal of Orthodontics. 2003;30(4):317-22.	Excluded; partial appliances
630	Gorelick L, Geiger AM, Gwinnett AJ. Incidence of white spot formation after bonding and banding. Am J Orthod. 1982;81(2):93-8.	Excluded; no comparison
631	Boersma JG, Van Der Veen MH, Lagerweij MD, Bokhout B, Prahl-Andersen B. Caries prevalence measured with QLF after treatment with fixed orthodontic appliances: Influencing factors. Caries Research. 2005;39(1):41-7.	Excluded; no comparison
632	Cantekin K, Celikoglu M, Karadas M, Yildirim H, Erdem A. Effects of orthodontic treatment with fixed appliances on oral health status: A comprehensive study. Journal of Dental Sciences. 2011;6(4):235-8.	Excluded; no comparison
633	Martignon S, Ekstrand KR, Lemos MI, Lozano MP, Higuera C. Plaque, caries level and oral hygiene habits in young patients receiving orthodontic treatment. Community Dental Health. 2010;27(3):133-8.	Excluded; no comparison
634	Tufekci E, Dixon JS, Gunsolley JC, Lindauer SJ. Prevalence of white spot lesions during orthodontic treatment with fixed appliances. Angle Orthodontist. 2011;81(2):206-10.	Excluded; no comparison
635	Al Mulla AH, Al Kharsa S, Birkhed D. Modified fluoride toothpaste technique reduces caries in orthodontic patients: A longitudinal, randomized clinical trial. Am J Orthod Dentofacial Orthop 2010;138(3):285-91.	Excluded; no white spot lesion assessment
636	Gray A, Ferguson MM. The use of low-tack chewing gum for individuals wearing orthodontic appliances. Aust Dent J. 1996;41(6):373-6.	Excluded; no white spot lesion assessment

637	Oltramari-Navarro PVP, Titarelli JM, Marsicano JA, Henriques JFC, Janson G, Lauris JRP, et al. Effectiveness of 0.50% and 0.75% chlorhexidine dentifrices in orthodontic patients: A double-blind and randomized controlled trial. Am J Orthod Dentofacial Orthop 2009;136(5):651-6.	Excluded; no white spot lesion assessment
638	Marini I, Pelliccioni GA, Vecchiet F, Alessandri Bonetti G, Checchi L. A retentive system for intra-oral fluoride release during orthodontic treatment. Eur J Orthod. 1999;21(6):695-701.	Excluded; no white spot lesion assessment
639	Zingler S, Pritsch M, Wrede DJ, Ludwig B, Bister D, Kneist S, et al. Randomized Controlled Trial A randomized clinical trial comparing the impact of different oral hygiene protocols and sealant applications on plaque, gingival, and caries index scores. Eur J Orthod 2014;36(2):150-63.	Excluded; no white spot lesion assessment
640	Al Mulla AH, Al Kharsa S, Kjellberg H, Birkhed D. Caries Risk Profiles in Orthodontic Patients at Follow-Up Using Cariogram. Angle Orthodontist. 2009;79(2):323-30.	Excluded; no white spot lesion assessment
641	Amasyali M, Enhos S, Uysal T, Saygun I, Kilic A, Bedir O. Effect of a self-etching adhesive containing an antibacterial monomer on clinical periodontal parameters and subgingival microbiologic composition in orthodontic patients. Am J Orthod Dentofacial Orthop 2011;140(4):E147-E53.	Excluded; no white spot lesion assessment
642	Fard BK, Ghasemi M, Rastgariyan H, Sajjadi SH, Emami H, Amani M, et al. Effectiveness of Mouth Washes on Streptococci in Plaque around Orthodontic Appliances. ISRN Dent. 2011;2011:954053.	Excluded; no white spot lesion assessment
643	Fricker JP. A 12-month clinical comparison of resin-modified light-activated adhesives for the cementation of orthodontic molar bands. Am J Orthod Dentofacial Orthop 1997;112(3).	Excluded; no white spot lesion assessment
644	Hua YM, Chen J, Jean G. The preventive effectiveness in reducing tooth decay and decalcification of different concentration of fluoride toothpaste for orthodontic patients. Hua xi kou qiang yi xue za zhi [West China journal of stomatology]. 2006;24(2):146-7.	Excluded; no white spot lesion assessment
645	Klaus K, Eichenauer J, Sprenger R, Ruf S. Oral microbiota carriage in patients with multibracket appliance in relation to the quality of oral hygiene. Head & Face Medicine. 2016;12.	Excluded; no white spot lesion assessment
646	Marchisio O, Esposito MR, Genovesi A. Salivary pH level and bacterial plaque evaluation in orthodontic patients treated with Recaldent products. International journal of dental hygiene. 2010;8(3):232-6.	Excluded; no white spot lesion assessment
647	Nishad A, Sreesan NS, Joy J, Lakshmanan L, Thomas J, Anjali VA. Impact of Mouthwashes on Antibacterial Activity of Subjects with Fixed Orthodontic Appliances: A Randomized Clinical Trial. J Contemp Dent Pract. 2017;18(12):1112-6.	Excluded; no white spot lesion assessment
648	Rangarajan S, Mogra S, Shetty VS, Shetty S, Jose NP. Comparison of contamination of low-frictional elastomeric rings with that of conventional elastomeric rings by Streptococcus mutans - An in-vivo study. Journal of Clinical and Diagnostic Research. 2015;9(4):ZC26-ZC9.	Excluded; no white spot lesion assessment
649	Sengun A, Sari Z, Ramoglu SI, Malkoc S, Duran I. Evaluation of the dental plaque pH recovery effect of a xylitol lozenge on patients with fixed orthodontic appliances. Angle Orthodontist. 2004;74(2):240-4.	Excluded; no white spot lesion assessment
650	Türkkahraman H, Sayin MO, Bozkurt FY, Yetkin Z, Kaya S, Onal S. Archwire ligation techniques, microbial colonization, and periodontal status in orthodontically treated patients. Angle orthodontist. 2005;75(2):231-6.	Excluded; no white spot lesion assessment
651	Wiltshire WA. In vitro and in vivo fluoride release from orthodontic elastomeric ligature ties. Am J Orthod Dentofacial Orthop 1999;115(3):288-92.	Excluded; no white spot lesion assessment
652	Zachrisson BU, Brobakken BO. Clinical comparison of direct versus indirect bonding with different bracket types and adhesives. American journal of orthodontics. 1978;74(1):62-78.	Excluded; no white spot lesion assessment
653	Alexandria AK, Nassur C, Nobrega CBC, Valenca AMG, Rosalen PL, Maia LC. In situ effect of titanium tetrafluoride varnish on enamel demineralization. Braz Oral Res. 2017;31:e86.	Excluded; ex vivo study
654	Farhadian N, Miresmaeili A, Eslami B, Mehrabi S. Effect of fluoride varnish on enamel demineralization around brackets: an in-vivo study. Am J Orthod Dentofacial Orthop 2008;133(4 Suppl):S95-8.	Excluded; ex vivo study
655	Garry AP, Flannigan NL, Cooper L, Komarov G, Burnside G, Higham SM. A randomised controlled trial to investigate the remineralising potential of Tooth Mousse in orthodontic patients. J Orthod. 2017;44(3):147-56.	Excluded; ex vivo study
656	Shah M, Paramshivam G, Mehta A, Singh S, Chugh A, Prashar A, et al. Comparative assessment of conventional and light-curable fluoride varnish in the prevention of enamel demineralization during fixed appliance therapy: a split-mouth randomized controlled trial. Eur J Orthod. 2018;40(2):132-9.	Excluded; ex vivo study
657	Shinaishin SF, Ghobashy SA, El-Bialy TH. Efficacy of light-activated sealant on enamel demineralization in orthodontic patients: an atomic force microscope evaluation. Open Dent J. 2011;5:179-86.	Excluded; ex vivo study
658	Restrepo M, Bussaneli DG, Jeremias F, Cordeiro RC, Raveli DB, Magalhaes AC, et al. Control of White Spot Lesions with Use of Fluoride Varnish or Chlorhexidine Gel During Orthodontic Treatment A Randomized Clinical Trial. J Clin Pediatr Dent. 2016;40(4):274-80.	Excluded; no preventive measures
659	Zimmer BW, Rottwinkel Y. Assessing patient-specific decalcification risk in fixed orthodontic treatment and its impact on prophylactic procedures. Am J Orthod Dentofacial Orthop. 2004;126(3):318-24.	Excluded; no preventive measures
660	Almosa NA, Lundgren T, Aldrees AM, Birkhed D, Kjellberg H. Diagnosing the severity of buccal caries lesions in governmental and private orthodontic patients at debonding, using the ICDAS-II and the DIAGNOdent Pen. Angle Orthodontist. 2014;84(3):430-6.	Excluded; no preventive measures
661	Eltayeb MK, Ibrahim YE, El Karim IA, Sanhouri NM. Distribution of white spot lesions among orthodontic patients attending teaching institutes in Khartoum. Bmc Oral Health. 2017;17.	Excluded; no preventive measures
662	Uysal T, Amasyali M, Ozcan S, Sagdic D. Demineralization properties of newly erupted and mature premolars around orthodontic brackets: An in-vivo study. Am J Orthod Dentofacial Orthop 2010;137(5):582.e1-.e6.	Excluded; no preventive measures
663	Akin M, Tezcan M, Ileri Z, Ayhan F. Incidence of white spot lesions among patients treated with self- and conventional ligation systems. Clinical Oral Investigations. 2015;19(6):1501-6.	Excluded; no randomization
664	Adolfsson U, Larsson E, Ögaard B. Bond failure of a no-mix adhesive during orthodontic treatment. Am J Orthod Dentofacial Orthop 2002;122(3):277-81.	Excluded; no randomization
665	Boyd RL. Comparison of three self-applied topical fluoride preparations for control of decalcification. Angle orthodontist. 1993;63(1):25-30.	Excluded; no randomization
666	Demito CF, Rodrigues GV, Ramos AL, Bowman SJ. Efficacy of a fluoride varnish in preventing white-spot lesions as measured with laser fluorescence. Journal of clinical orthodontics. 2011;45(1):25-9; quiz 40.	Excluded; no randomization
667	Hadler-Olsen S, Sandvik K, El-Agroudi MA, Ogaard B. The incidence of caries and white spot lesions in orthodontically treated adolescents with a comprehensive caries prophylactic regimen-a prospective study. Eur J Orthod 2012;34(5):633-9.	Excluded; no randomization
668	Heinig N, Hartmann A. Efficacy of a sealant : study on the efficacy of a sealant (Light Bond) in preventing decalcification during multibracket therapy. Fortschritte der Kieferorthopadie [Journal of orofacial orthopedics]. 2008;69(3):154-67.	Excluded; no randomization
669	Jurisic S, Kozomara D, Juric H, Verzak Z, Jurisic G. The influence of different types of brackets and efficacy of two chlorhexidine mouthwashes on oral hygiene and the incidence of white spot lesions in adolescents during the orthodontic therapy. Psychiatria danubina. 2016;28:63-8.	Excluded; no randomization
670	Knosel M, Ellenberger D, Goldner Y, Sandoval P, Wiechmann D. In-vivo durability of a fluoride-releasing sealant (OpalSeal) for protection against white-spot lesion formation in orthodontic patients. Head & face medicine. 2015;11:11.	Excluded; no randomization
671	Knösel M, Klang E, Helms HJ, Wiechmann D. Occurrence and severity of enamel decalcification adjacent to bracket bases and sub-bracket lesions during orthodontic treatment with two different lingual appliances. Eur J Orthod 2016;38(5):485-92.	Excluded; no randomization
672	Ogaard B, Rolla G, Arends J, ten Cate JM. Orthodontic appliances and enamel demineralization. Part 2. Prevention and treatment of lesions. Am J Orthod Dentofacial Orthop 1988;94(2).	Excluded; no randomization
673	Øgaard B, Rølla G, Arends J. Orthodontic appliances and enamel demineralization. Part 1. Lesion development. Am J Orthod Dentofacial Orthop 1988;94(1):68-73.	Excluded; no randomization
674	Sonis AL, Snell W. An evaluation of a fluoride-releasing, visible light-activated bonding system for orthodontic bracket placement. Am J Orthod Dentofacial Orthop 1989;95(4).	Excluded; no randomization
675	Stratemann MW, Shannon IL. Control of decalcification in orthodontic patients by daily self- administered application of a water-free 0.4 per cent stannous fluoride gel. American journal of orthodontics. 1974;66(3).	Excluded; no randomization
676	Tufekci E, Casagrande ZA, Lindauer SJ, Fowler CE, Williams KT. Effectiveness of an essential oil mouthrinse in improving oral health in orthodontic patients. Angle orthodontist. 2008;78(2):294-8.	Excluded; no randomization
677	Wright AB, Lee RT, Lynch E, Young KA. Clinical and microbiologic evaluation of a resin modified glass ionomer cement for orthodontic bonding. Am J Orthod Dentofacial Orthop 1996;110(5):469-75.	Excluded; no randomization
678	Hoffman DA, Clark AE, Rody WJ, Jr., McGorray SP, Wheeler TT. A prospective randomized clinical trial into the capacity of a toothpaste containing NovaMin to prevent white spot lesions and gingivitis during orthodontic treatment. Prog Orthod. 2015;16:25.	Excluded; intervention mid-treatment
679	Robertson MA, Kau CH, English JD, Lee RP, Powers J, Nguyen JT. MI Paste Plus to prevent demineralization in orthodontic patients: a prospective randomized controlled trial. Am J Orthod Dentofacial Orthop. 2011;140(5):660-8.	Excluded; intervention mid-treatment
680	Skold-Larsson K, Sollenius O, Karlsson L, Petersson LG, Twetman S. Effect of fluoridated milk on enamel demineralization adjacent to fixed orthodontic appliances. Acta Odontol Scand. 2013;71(3-4):464-8.	Excluded; intervention mid-treatment
681	Alavi S, Yaraghi N. The effect of fluoride varnish and chlorhexidine gel on white spots and gingival and plaque indices in fixed orthodontic patients: A placebo-controlled study. Dental Research Journal. 2018;15(4):276-82.	Excluded; intervention mid-treatment
682	Llena-Puy C. MI paste plus and PreviDent fluoride varnish appear no more effective than normal home care for improving the appearance of white spot lesions. J Evid Based Dent Pract. 2013;13(3):114-6.	Excluded; intervention post-treatment
683	Al Maaitah EF, Abu Omar AA, Al-Khateeb SN. Effect of fixed orthodontic appliances bonded with different etching techniques on tooth color: A prospective clinical study. Am J Orthod Dentofacial Orthop 2013;144(1):43-9.	Excluded; only tooth color assessed
684	Alexander SA, Ripa LW. Effects of self-applied topical fluoride preparations in orthodontic patients. Angle Orthod. 2000;70(6):424-30.	Excluded; not eligible for meta-analysis
685	Banks PA, Chadwick SM, Asher-McDade C, Wright JL. Fluoride-releasing elastomerics--a prospective controlled clinical trial. Eur J Orthod 2000;22(4):401-7.	Excluded; not eligible for meta-analysis
686	Bechtold TE, Sobiegalla A, Markovic M, Berneburg M, Goz GR. In vivo effectiveness of enamel sealants around orthodontic brackets. J Orofac Orthop. 2013;74(6):447-57.	Excluded; not eligible for meta-analysis
687	Boyd RL, Rose CM. Effect of rotary electric toothbrush versus manual toothbrush on decalcification during orthodontic treatment. Am J Orthod Dentofacial Orthop. 1994;105(5):450-6.	Excluded; not eligible for meta-analysis
688	Buck T, Pellegrini P, Sauerwein R, Leo MC, Covell DA, Jr., Maier T, et al. Elastomeric-ligated vs self-ligating appliances: a pilot study examining microbial colonization and white spot lesion formation after 1 year of orthodontic treatment. Orthodontics (Chic). 2011;12(2):108-21.	Excluded; not eligible for meta-analysis
689	Dalessandri D, Dalessandri M, Bonetti S, Visconti L, Paganelli C. Effectiveness of an indirect bonding technique in reducing plaque accumulation around braces. Angle Orthod. 2012;82(2):313-8.	Excluded; not eligible for meta-analysis
690	Elaut J, Wehrbein H. The effects of argon laser curing of a resin adhesive on bracket retention and enamel decalcification: a prospective clinical trial. Eur J Orthod 2004;26(5):553-60.	Excluded; not eligible for meta-analysis
691	Ghajari MF, Eslamian L, Naji RA, Morovati S. Efficacy of glass ionomer cements for prevention of white spot lesions during orthodontic banding: a randomized clinical trial. Journal of Dentistry (Tehran University of Medical Science and Health Services) 2015;12(12):913-20.	Excluded; not eligible for meta-analysis
692	Nazir M, Walsh T, Mandall NA, Matthew S, Fox D. Banding versus bonding of first permanent molars: a multi-centre randomized controlled trial. J Orthod. 2011;38(2):81-9.	Excluded; not eligible for meta-analysis

693	Ghiz MA, Ngan P, Kao E, Martin C, Gunel E. Effects of sealant and self-etching primer on enamel decalcification. Part II: an in-vivo study. Am J Orthod Dentofacial Orthop. 2009;135(2):206-13.	Excluded; not eligible for meta-analysis
694	Gillgrass TJ, Benington PC, Millett DT, Newell J, Gilmour WH. Modified composite or conventional glass ionomer for band cementation? A comparative clinical trial. Am J Orthod Dentofacial Orthop. 2001;120(1):49-53.	Excluded; not eligible for meta-analysis
695	Gizani S, Petsi G, Twetman S, Caroni C, Makou M, Papagianoulis L. Effect of the probiotic bacterium Lactobacillus reuteri on white spot lesion development in orthodontic patients. Eur J Orthod 2016;38(1):85-9.	Excluded; not eligible for meta-analysis
696	Hammad SM, Knosel M. Efficacy of a new sealant to prevent white spot lesions during fixed orthodontic treatment : A 12-month, single-center, randomized controlled clinical trial. J Orofac Orthop. 2016;77(6):439-45.	Excluded; not eligible for meta-analysis
697	Huang XH, He K. Influence of three types of toothbrushes on enamel decalcification in orthodontic patients: A comparative study. Chinese Journal of Tissue Engineering Research. 2015;19(12):1832-6.	Excluded; not eligible for meta-analysis
698	Jahanbin A, Farzanegan F, Atai M, Jamehdar SA, Golfakhrabadi P, Shafaee H. A comparative assessment of enamel mineral content and Streptococcus mutans population between conventional composites and composites containing nano amorphous calcium phosphate in fixed orthodontic patients: a split-mouth randomized clinical trial. Eur J Orthod 2017;39(1):43-51.	Excluded; not eligible for meta-analysis
699	Jiang H, Hua F, Yao L, Tai B, Du M. Effect of 1.23% acidulated phosphate fluoride foam on white spot lesions in orthodontic patients: a randomized trial. Pediatr Dent. 2013;35(3):275-8.	Excluded; not eligible for meta-analysis
700	Kirschneck C, Christl JJ, Reicheneder C, Proff P. Efficacy of fluoride varnish for preventing white spot lesions and gingivitis during orthodontic treatment with fixed appliances-a prospective randomized controlled trial. Clinical Oral Investigations. 2016;20(9):2371-8.	Excluded; not eligible for meta-analysis
701	Kvam E, Broch J, Nissen-Meyer IH. Comparison between a zinc phosphate cement and a glass ionomer cement for cementation of orthodontic bands. Eur J Orthod 1983;5:307-13.	Excluded; not eligible for meta-analysis
702	Le PT, Weinstein M, Borislow AJ, Braitman LE. Bond failure and decalcification: a comparison of a cyanoacrylate and a composite resin bonding system in vivo. Am J Orthod Dentofacial Orthop 2003;123(6):624-7.	Excluded; not eligible for meta-analysis
703	Leizer C, Weinstein M, Borislow AJ, Braitman LE. Efficacy of a filled-resin sealant in preventing decalcification during orthodontic treatment. Am J Orthod Dentofacial Orthop 2010;137(6):796-800.	Excluded; not eligible for meta-analysis
704	Liptak L, Szabo K, Nagy G, Marton S, Madlena M. Microbiological Changes and Caries-Preventive Effect of an Innovative Varnish Containing Chlorhexidine in Orthodontic Patients. Caries Res. 2018;52(4):272-8.	Excluded; not eligible for meta-analysis
705	Mattick CR, Mitchell L, Chadwick SM, Wright J. Fluoride-releasing elastomeric modules reduce decalcification: a randomized controlled trial. J Orthod. 2001;28(3):217-9.	Excluded; not eligible for meta-analysis
706	Miller CC, Burnside G, Higham SM, Flannigan NL. Quantitative Light-induced Fluorescence-Digital as an oral hygiene evaluation tool to assess plaque accumulation and enamel demineralization in orthodontics. Angle Orthodontist. 2016;86(6):991-7.	Excluded; not eligible for meta-analysis
707	Millett DT, McCluskey LA, McAuley F, Creanor SL, Newell J, Love J. A comparative clinical trial of a compomer and a resin adhesive for orthodontic bonding. Angle Orthod. 2000;70(3):233-40.	Excluded; not eligible for meta-analysis
708	Ogaard B, Alm AA, Larsson E, Adolfsson U. A prospective, randomized clinical study on the effects of an amine fluoride/stannous fluoride toothpaste/mouthrinse on plaque, gingivitis and initial caries lesion development in orthodontic patients. Eur J Orthod. 2006;28(1):8-12.	Excluded; not eligible for meta-analysis
709	Perrini F, Lombardo L, Arreghini A, Medori S, Siciliani G. Caries prevention during orthodontic treatment: In-vivo assessment of high-fluoride varnish to prevent white spot lesions. Am J Orthod Dentofacial Orthop. 2016;149(2):238-43.	Excluded; not eligible for meta-analysis
710	Polat O, Gokcelik A, Arman A, Arhun N. A comparison of white spot lesion formation between a self-ligating bracket and a conventional preadjusted straight wire bracket. World J Orthod. 2008;9(2):e46-50.	Excluded; not eligible for meta-analysis
711	Raghis T, Mahmoud G, Abdullah A, Hamadah O. Enamel resistance to demineralisation around orthodontic brackets after CO2 laser irradiation: a randomised clinical trial. J Orthod. 2018:1-9.	Excluded; not eligible for meta-analysis
712	Shungin D, Olsson AI, Persson M. Orthodontic treatment-related white spot lesions: A 14-year prospective quantitative follow-up, including bonding material assessment. Am J Orthod Dentofacial Orthop 2010;138(2).	Excluded; not eligible for meta-analysis
713	Sonesson M, Twetman S, Bondemark L. Effectiveness of high-fluoride toothpaste on enamel demineralization during orthodontic treatment-a multicenter randomized controlled trial. Eur J Orthod. 2014;36(6):678-82.	Excluded; not eligible for meta-analysis
714	van der Kaaij NC, van der Veen MH, van der Kaaij MA, ten Cate JM. A prospective, randomized placebo-controlled clinical trial on the effects of a fluoride rinse on white spot lesion development and bleeding in orthodontic patients. Eur J Oral Sci. 2015;123(3):186-93.	Excluded; not eligible for meta-analysis
715	van der Veen MH, Attin R, Schwestka-Polly R, Wiechmann D. Caries outcomes after orthodontic treatment with fixed appliances: do lingual brackets make a difference? Eur J Oral Sci. 2010;118(3):298-303.	Excluded; not eligible for meta-analysis
716	Yildirim K, Saglam-Aydinatay B. Comparative assessment of treatment efficacy and adverse effects during nonextraction orthodontic treatment of Class I malocclusion patients with direct and indirect bonding: A parallel randomized clinical trial. Am J Orthod Dentofacial Orthop. 2018;154(1):26-34.e1.	Excluded; not eligible for meta-analysis
717	Adriaens ML, Dermaut LR, Verbeeck RM. The use of 'Fluor Protector', a fluoride varnish, as a caries prevention method under orthodontic molar bands. Eur J Orthod. 1990;12(3):316-9.	Included
718	Alabdullah MM, Nabawia A, Ajaj MA, Saltaji H. Effect of fluoride-releasing resin composite in white spot lesions prevention: a single-centre, split-mouth, randomized controlled trial. Eur J Orthod. 2017;39(6):634-40.	Included
719	Banks PA, Burn A, O'Brien K. A clinical evaluation of the effectiveness of including fluoride into an orthodontic bonding adhesive. Eur J Orthod. 1997;19(4):391-5.	Included
720	Banks PA, Richmond S. Enamel sealants: a clinical evaluation of their value during fixed appliance therapy. Eur J Orthod 1994;16(1):19-25.	Included
721	Benham AW, Campbell PM, Buschang PH. Effectiveness of pit and fissure sealants in reducing white spot lesions during orthodontic treatment. A pilot study. Angle Orthod. 2009;79(2):338-45.	Included
722	Eppright M, Shroff B, Best AM, Barcoma E, Lindauer SJ. Influence of active reminders on oral hygiene compliance in orthodontic patients. Angle Orthod. 2014;84(2):208-13.	Included
723	Fornell AC, Skold-Larsson K, Hallgren A, Bergstrand F, Twetman S. Effect of a hydrophobic tooth coating on gingival health, mutans streptococci, and enamel demineralization in adolescents with fixed orthodontic appliances. Acta Odontol Scand. 2002;60(1):37-41.	Included
724	Gaworski M, Weinstein M, Borislow AJ, Braitman LE. Decalcification and bond failure: a comparison of a glass ionomer and a composite resin bonding system in vivo. Am J Orthod Dentofacial Orthop 1999;116(5):518-21.	Included
725	Jejurikar H, Nene S, Kalia A, Gupta G, Mirdehghan N. Does text messaging reminder help in the orthodontic compliance of patients to maintain their oral hygiene? Oral Hyg Health. 2014;2:152.	Included
726	Kumar GS, Kashyap A, Raghav S, Bhardwaj R, Singh A, Guram G. Role of Text Message Reminder on Oral Hygiene Maintenance of Orthodontic Patients. J Contemp Dent Pract. 2018;19(1):98-101.	Included
727	Kumar Jena A, Pal Singh S, Kumar Utreja A. Efficacy of resin-modified glass ionomer cement varnish in the prevention of white spot lesions during comprehensive orthodontic treatment: a split-mouth study. J Orthod. 2015;42(3):200-7.	Included
728	Marcusson A, Norevall LI, Persson M. White spot reduction when using glass ionomer cement for bonding in orthodontics: a longitudinal and comparative study. Eur J Orthod 1997;19(3):233-42.	Included
729	Millett DT, Nunn JH, Welbury RR, Gordon PH. Decalcification in relation to brackets bonded with glass ionomer cement or a resin adhesive. Angle Orthod. 1999;69(1):65-70.	Included
730	Mitchell L. An investigation into the effect of a fluoride releasing adhesive on the prevalence of enamel surface changes associated with directly bonded orthodontic attachments. British journal of orthodontics. 1992;19(3).	Included
731	Ogaard B, Larsson E, Glans R, Henriksson T, Birkhed D. Antimicrobial effect of a chlorhexidine-thymol varnish (Cervitec) in orthodontic patients. A prospective, randomized clinical trial. J Orofac Orthop. 1997;58(4):206-13.	Included
732	Ogaard B, Larsson E, Henriksson T, Birkhed D, Bishara SE. Effects of combined application of antimicrobial and fluoride varnishes in orthodontic patients. Am J Orthod Dentofacial Orthop. 2001;120(1):28-35.	Included
733	O'Reilly MT, De Jesus Vinas J, Hatch JP. Effectiveness of a sealant compared with no sealant in preventing enamel demineralization in patients with fixed orthodontic appliances: a prospective clinical trial. Am J Orthod Dentofacial Orthop. 2013;143(6):837-44.	Included
734	Stecksen-Blicks C, Renfors G, Oscarson ND, Bergstrand F, Twetman S. Caries-preventive effectiveness of a fluoride varnish: a randomized controlled trial in adolescents with fixed orthodontic appliances. Caries Res. 2007;41(6):455-9.	Included
735	Trimpeneers LM, Dermaut LR. A clinical evaluation of the effectiveness of a fluoride-releasing visible light-activated bonding system to reduce demineralization around orthodontic brackets. Am J Orthod Dentofacial Orthop. 1996;110(2):218-22.	Included
736	Turner PJ. The clinical evaluation of a fluoride-containing orthodontic bonding material. Br J Orthod. 1993;20(4):307-13.	Included
737	van der Linden RP, Dermaut LR. White spot formation under orthodontic bands cemented with glass ionomer with or without Fluor Protector. Eur J Orthod. 1998;20(3):219-24.	Included
738	Vivaldi-Rodrigues G, Demito CF, Bowman SJ, Ramos AL. The effectiveness of a fluoride varnish in preventing the development of white spot lesions. World J Orthod. 2006;7(2):138-44.	Included
739	Wenderoth CJ, Weinstein M, Borislow AJ. Effectiveness of a fluoride-releasing sealant in reducing decalcification during orthodontic treatment. Am J Orthod Dentofacial Orthop. 1999;116(6):629-34.	Included
740	Zotti F, Dalessandri D, Salgarello S, Piancino M, Bonetti S, Visconti L, et al. Usefulness of an app in improving oral hygiene compliance in adolescent orthodontic patients. Angle Orthodontist. 2016;86(1):101-7.	Included

* checked for available publications.

Table S3. Characteristics of included trials on banded molars.

Study	Design; Setting; Country*	Patients (M/F); age†	OH	F	Intervention
Adriaens 1990	$_{wp}$RCT; Uni; BEL	G1/2: 28 (NR/NR); NR	OHI	NR	G1: F-varnish + CEM (GI) G2: CEM (GI)
van der Linden 1998	$_{wp}$RCT; Uni; BEL	G1/2: 18(NR); NR	OHI	-T-PAS (I)	G1: F-varnish + CEM (GI) G2: CEM (GI)

* countries are given with their ISO ALPHA-3 codes
† age is given either as mean (one number) or when mean is unavailable as rang (in parenthesis)—all in years

CEM, cement; CR, composite resin; G, group; GI, glass ionomer; Hosp, hospital; MWASH, mouthwash; NR, not reported; OHI, oral hygiene instruction; Pract, private practice; $_{p}$RCT, parallel randomized controlled trial; RMGI, resin modified glass ionomer; TPAS, toothpaste; Uni, university clinic; $_{wp}$RCT, within-persons randomized controlled trial; yr, year; ZP, zinc phosphate.

Table S4a. Risk of bias of included studies on bracketed teeth.

Study	Sequence generation	Allocation concealment	Blinding of participants/ personnel	Blinding of outcome assessors	Incomplete outcome data	Selective outcome reporting	Other sources of bias	Overall
Allabdullah 2017	**Low risk** – "The patients were randomly assigned using a computer-generated random number table to one of the two intervention groups…"	**Low risk** – "…using consecutive, opaque, sealed envelopes that included the randomization sequence. This was generated by an assistant (who was not involved in the study)…"	**Low risk** – "The blinding of patients, outcome assessor and therapist were achieved throughout the trials. To help with maintaining blinding, both the control and study resin' tubes were covered with opaque black tape (by an external person), in this way, no connection could be made between the tubes and the types of bonding.". Also, blinded assessor.	**Low risk** – see previous cell.	**Low risk** – low drop-out rate (12%), while within-person design ensures balance across randomization groups.	**Unclear** – no obvious selective reporting; it is difficult to judge however whether selective reporting is a problem, as no protocol exists.	**Unclear** – data are clustered, but this has been accounted for. However, the risk of effect contamination across randomized mouth quadrants is unclear.	**Unclear**
Banks 1994	**High risk** – quasi-randomization: "In a similar fashion, alternate teeth (306 experimental teeth) were treated by totally sealing the facial surfaces with a non-viscous visible light-activated sealant…"	**Unclear** – no information provided.	**High risk** – patients and treatment providers were not blinded, but orthodontic treatment providers could have been. Outcome is objective, but has not been assessed blindly.	**High risk** – Outcome is objective, but has not been assessed blindly.	**Low risk** – no drop-outs reported.	**High risk** – a categorical white spot lesion severity index (0-3 points) has been used, but data are given as modified data with different categories (0-12 points); also, it is difficult to judge however whether selective reporting is a problem, as no protocol exists.	**Unclear** – data are clustered and this has not been accounted for in the analyses.	**High risk**
Banks 1997	**Unclear** – unclear information on random sequence generation: "Contralateral quadrants were randomly allocated as experimental and control so that where both arches were treated the allocation was reversed in the opposing arch".	**Unclear** – no information provided.	**High risk** – patients and treatment providers were not blinded, but orthodontic treatment providers could have been. Outcome is objective, but has not been assessed blindly.	**High risk** – Outcome is objective, but has not been assessed blindly.	**Low risk** – no drop-outs reported.	**High risk** – a categorical white spot lesion severity index (0-3 points) has been used, but data are given as modified data with different categories (0-6 points); also, it is difficult to judge however whether selective reporting is a problem, as no protocol exists.	**Unclear** – data are clustered and this has not been accounted for in the analyses. Also, the risk of effect contamination across randomized teeth is unclear.	**High risk**
Benham 2009	**Low risk** – "The sides were allocated prior to the start of the study by a random number generator".	**Unclear** – no information provided.	**High risk** – patients and treatment providers were not blinded, but orthodontic treatment providers could have been. Outcome is objective, but has not been assessed blindly.i	**High risk** – Outcome is objective, but has not been assessed blindly.	**Low risk** – no drop-outs reported.	**High risk** – only one fourth of the patients are included—the remaining ¾ who had prolonged treatment (and therefore higher white spot risk) were not reported; also, it is difficult to judge however whether selective reporting is a problem, as no protocol exists.	**Unclear** – data are clustered and this has not been accounted for in the analyses.	**High risk**
Eppright 2014	**Unclear** – unclear information on random sequence generation: "Subjects were randomly assigned to one of two groups, a text message or control group, using a block randomization protocol"	**Unclear** – no information provided.	**Unclear** – patients and treatment providers were not blinded, but orthodontic treatment providers could have been. However, the outcome is objective and has been assessed blindly.	**Low risk** – "Oral hygiene instruction and study measurements were performed by the same blinded examiner two appointments after baseline (T1) and four appointments after baseline (T2)"	**Low risk** – one subject from each group did not complete the study but the overall dropout rate was low (5%) and balanced between groups	**Unclear** – no obvious selective reporting; it is difficult to judge however whether selective reporting is a problem, as no protocol exists.	**Low risk** – no other sources.	**Unclear**
Fornell 2002	**Unclear** – unclear information on random sequence generation: "After bracket insertion, the polymer coating was applied randomly to the buccal surfaces of all teeth of the first or second quadrant, leaving the teeth in the opposite quadrant as untreated controls".	**Unclear** – no information provided.	**Unclear** – patients and treatment providers were not blinded, but orthodontic treatment providers could have been. However, the outcome is objective and has been assessed blindly.	**Low risk** – "In addition, the enamel surfaces of all teeth planned for band and bracket bonding were thoroughly examined by visual inspection before the insertion of the appliances and immediately after removal by one blinded examiner."	**Low risk** – one drop-out only reported (immediately after baseline).	**Unclear** – no obvious selective reporting; it is difficult to judge however whether selective reporting is a problem, as no protocol exists.	**Unclear** – data are clustered, and this has not been adequately accounted for.	**Unclear**
Gaworski 1999	**High risk** – quasi-randomization: "The odd numbered teeth were bonded with a traditional composite resin system (…). The even-numbered teeth were be bonded with a glass ionomer system (…).	**Unclear** – no information provided.	**High risk** – patients and treatment providers were not blinded, but orthodontic treatment providers could have been. Outcome is objective, but has not been assessed blindly.	**High risk** – Outcome is objective, but has not been assessed blindly.	**Low risk** – no drop-outs reported.	**Unclear** – no obvious selective reporting; it is difficult to judge however whether selective reporting is a problem, as no protocol exists.	**Unclear** – data are clustered and this has not been accounted for in the analyses. Also, the risk of effect contamination across randomized teeth is unclear.	**High risk**
Jejurikar 2014	**Unclear** – unclear information on random sequence generation: "… were randomly assigned ..."	**Unclear** – no information provided.	**High risk** – patients and treatment providers were not blinded, but orthodontic treatment providers could have been. Outcome is objective, but has not been assessed blindly.	**High risk** – Outcome is objective, but has not been assessed blindly.	**Low risk** – no drop-outs reported.	**Unclear** – no obvious selective reporting; it is difficult to judge however whether selective reporting is a problem, as no protocol exists.	**Low risk** – no other sources.	**High risk**
Kumar Jena 2015	**Low risk** – "The sides (control and experimental) were allocated before the beginning of study by random number generator".	**Unclear** – no information provided.	**Unclear** – patients and treatment providers were not blinded, but orthodontic treatment providers could have been. However, the outcome is objective and has been assessed blindly.	**Low risk** – "The evaluator was blinded to the control and experimental teeth during final (T1) evaluation."	**Low risk** – no drop-outs reported.	**High risk** – a categorical white spot lesion severity index has been used, but data are given as average across categories in a continuous manner; also, it is difficult to judge however whether selective reporting is a problem, as no protocol exists.	**Unclear** – data are clustered, and this has not been adequately accounted for.	**High risk**
Kumar 2018	**Unclear** – no information provided.	**Unclear** – no information provided.	**High risk** – patients and treatment providers were not blinded, but orthodontic treatment	**High risk** – Outcome is objective, but has not been assessed blindly.	**Low risk** – no drop-outs reported.	**Unclear** – no obvious selective reporting; it is difficult to judge	**Low risk** – no other sources.	**High risk**

			providers could have been. Outcome is objective, but has not been assessed blindly.			however whether selective reporting is a problem, as no protocol exists.		
Marcusson 1997	**Unclear** – unclear information on random sequence generation: "For each jaw the two bonding materials were selected according to random procedure and a split-mouth technique".	**Unclear** – no information provided.	**Unclear** – patients and treatment providers were not blinded, but orthodontic treatment providers could have been. However, the outcome is objective and has been assessed blindly.	**Low risk** – "The observers were unaware of which teeth had been cemented with AquaCem ® and which teeth had been bonded with Unite ®".	**Low risk** – no drop-outs reported at debonding. 27% drop-out rate at patient level 2 years post-debond, but this does not correspond to the primary scope of this review.	**Unclear** – no obvious selective reporting; it is difficult to judge however whether selective reporting is a problem, as no protocol exists.	**Unclear** – data are clustered and this has not been accounted for in the analyses. Also, the risk of effect contamination across randomized mouth quadrants is unclear.	**Unclear**
Millett 1999	**High risk** – quasi-randomization: "This trial took the form of a halfmouth study with patients allocated alternately to have the right or left side of the upper labial segment bonded with the conventional glass ionomer cement, Ketac-Cem".	**Unclear** – no information provided.	**Unclear** – patients and treatment providers were not blinded, but orthodontic treatment providers could have been. However, the outcome is objective and has been assessed blindly.	**Low risk** – "Examiners were blinded as to which teeth had been bonded with either material".	**Low risk** – drop-outs reported and justified by reasons not related to demineralizations (bond failure and paired nature of observations).	**Unclear** – no obvious selective reporting; it is difficult to judge however whether selective reporting is a problem, as no protocol exists.	**Unclear** – data are clustered and this has not been accounted for in the analyses. Also, the risk of effect contamination across randomized mouth quadrants is unclear.	**High risk**
Mitchell 1992	**Unclear** – unclear information on random sequence generation: "Allocation of test side (Direct®) was made randomly and brackets on the maxillary incisors and canine in that quadrant placed using Direct® in accordance with the manufacturers' instructions"	**Unclear** – no information provided.	**Unclear** – patients and treatment providers were not blinded, but orthodontic treatment providers could have been. However, the outcome is objective and has been assessed blindly.	**Low risk** – "However, the examiner was unaware of which teeth were test teeth and which were control teeth."	**Unclear** – 24 patients were randomized, but only 62 pairs of teeth were finally analyzed: "Sixty-two matched pairs of test and control teeth were contributed by these patients, as not every patient had all six upper anterior teeth bonded"	**Unclear** – no obvious selective reporting; it is difficult to judge however whether selective reporting is a problem, as no protocol exists.	**Unclear** – data are clustered and this has not been accounted for in the analyses. Also, the risk of effect contamination across randomized mouth quadrants is unclear.	**Unclear**
Ogaard 1997; 2001	**Low risk** – Randomization unclear, but probably adequate: "The participants were allocated into 2 groups according to a randomized table"	**Unclear** – no information provided.	**High risk** – patients and treatment providers were not blinded, but orthodontic treatment providers could have been. Outcome is objective, but has not been assessed blindly.	**High risk** – Outcome is objective, but has not been assessed blindly.	**Low risk** – no drop-outs reported.	**High risk** – a categorical white spot lesion severity index has been used, but data are given as average across categories in a continuous manner; also, it is difficult to judge however whether selective reporting is a problem, as no protocol exists.	**Unclear** – data are clustered and this has not been accounted for in the analyses.	**High risk**
O'Reilly 2013	**Low risk** – "The coordinating center prepared a treatment allocation schedule for each practice with a computer algorithm www.randomization.com).".	**Low risk** – "Each practice received a series of note cards, sealed in heavy opaque envelopes, that indicated whether the left canine would be a test or a control tooth"	**High risk** – patients and treatment providers were not blinded, but orthodontic treatment providers could have been. Outcome is objective, but has not been assessed blindly.	**High risk** – Outcome is objective, but has not been assessed blindly.	**Low risk** – Low drop out rate (5%) and justified by reasons not related to the intervention.	**High risk** – a categorical white spot lesion severity index has been used, but data are given as average across categories in a continuous manner; also, it is difficult to judge however whether selective reporting is a problem, as no protocol exists. Also, one clear major protocol deviation is reported, in which one practice neglected to perform the final visual examination on its subjects. Therefore, white spot lesion incidence and severity were estimated from photo- graphs taken at debonding for the 6 subjects of this practice.	**Low risk** – no other sources. Clustered data, but this was probably taken adequately into account.	**High risk**
Stecksen-Blicks 2007	**Low risk** – "The patients were assigned to one of the two groups on the basis of odd and even numbers from a dice".	**Unclear** – no information provided.	**Low risk** – patients and treatment providers were blinded: "Neither clinicians nor patients knew whether they were treated with fluoride or placebo varnish". Also, the outcome is objective and has been assessed blindly.	**Low risk** – "The examiners were not involved in the treatment of the patients and blinded for the group assignment".	**Low risk** – low drop-out rate (6%), with all drop-outs explained and treatment abortion equally distributed across randomization groups.	**Unclear** – no obvious selective reporting; it is difficult to judge however whether selective reporting is a problem, as no protocol exists.	**Low risk** – no other sources.	**Unclear**
Trimpeneers 1996	**Unclear** – unclear information on random sequence generation: "Maxillary right and mandibular left quadrants were designated at random as the "Orthon group," and the contralateral quadrants as the "Lee group"	**Unclear** – no information provided.	**Unclear** – patients and treatment providers were not blinded, but orthodontic treatment providers could have been. However, the outcome is objective and has been assessed blindly.	**Low risk** – outcome assessed probably blindly: "All slides were randomly projected in an attempt to simulate a blind test and scored by five different observers to prevent bias".	**High risk** – bonded teeth that failed during treatment or teeth that were for any other reason rebonded were not included in the analysis, because (according to the authors) the act of replacing the bracket could affect the	**Unclear** – no obvious selective reporting; it is difficult to judge however whether selective reporting is a problem, as no protocol exists.	**Unclear** – data are clustered and this has not been accounted for in the analyses. Also, the risk of effect contamination across randomized mouth quadrants is unclear.	**High risk**

					incidence of decalcification. However, white spot lesions could have already formed at debond time.			
Turner 1993	**Unclear** – unclear information on random sequence generation: "A split mouth technique was employed for the study, using randomly assigned quadrants for experimental and control sides".	**Unclear** – no information provided.	**Unclear** – patients and treatment providers were not blinded, but orthodontic treatment providers could have been. However, the outcome is objective and has been assessed blindly.	**Low risk** – outcome assessed probably blindly: "Plaque and gingival index scores were taken (always by the same operator) prior to bonding and at 3-, 6-, and 12-month intervals, without knowing which were the experimental and control quadrants". The same was presumably done for white spots.	**Low risk** – no drop-outs reported.	**High risk** – a categorical white spot lesion severity index has been used, but data are given as only as prevalence and not in severity categories; also, it is difficult to judge however whether selective reporting is a problem, as no protocol exists. Also, data for only 28 of the initial 42 randomized patients are given in this report.	**Unclear** – data are clustered and this has not been accounted for in the analyses. Also, the risk of effect contamination across randomized mouth quadrants is unclear.	**High risk**
Vivaldi-Rodrigues 2006	**Unclear** – unclear information on random sequence generation: "maxillary right and mandibular left) were designated at random as the experimental group and the contralateral quadrants assigned as the control group".	**Unclear** – no information provided.	**Unclear** – patients and treatment providers were not blinded, but orthodontic treatment providers could have been. However, the outcome is objective and has been assessed blindly.	**Low risk** – "Two calibrated examiners performed a double-blinded examination of the photographs taken before and after 12 months of orthodontic treatment and the tri-monthly applications of fluoride varnish to the experimental quadrants."	**Low risk** – no drop-outs reported.	**High risk** – a categorical white spot lesion severity index has been used, but data are given as average across categories in a continuous manner; also, it is difficult to judge however whether selective reporting is a problem, as no protocol exists.	**Unclear** – data are clustered and this has not been accounted for in the analyses. Also, the risk of effect contamination across randomized mouth quadrants is unclear.	**High risk**
Wenderoth 1999	**High risk** – quasi-randomization: "For each patient the odd numbered teeth (…) served as the experimental group with the experimental sealant applied after placement of orthodontic brackets".	**Unclear** – no information provided.	**Unclear** – patients and treatment providers were not blinded, but orthodontic treatment providers could have been. However, the outcome is objective and has been assessed blindly (probably).	**Low risk** – outcome assessment (probably) done blindly: "All slides were randomly projected in an attempt to simulate a blind test and scored by 7 different observers to prevent bias."	**Low risk** – very low (4%) drop-outs reported.	**High risk** – a categorical white spot lesion severity index has been used, but data are given as solely as progression of ratings and not actual teeth within each rating; also, it is difficult to judge however whether selective reporting is a problem, as no protocol exists.	**Unclear** – data are clustered and this has not been accounted for in the analyses.	**High risk**
Zotti 2016	**Low risk** – randomization sequence generation unclear, but probably adequate: "…and a stratified randomization list was produced by an external office, taking into account baseline dental health, gender, age, and socioeconomic status"	**Low risk** – central allocation deemed adequate (although partially unclear): "The external office was then contacted for patient allocation to the control group (CG) or study group (SG)."	**Unclear** – patients and treatment providers were not blinded, but orthodontic treatment providers could have been. However, the outcome is objective and has been assessed blindly.	**Low risk** – "Oral hygiene instruction and study measurements were performed by the same blinded examiner two appointments after baseline (T1) and four appointments after baseline (T2)"	**Low risk** – no drop-outs reported.	**Unclear** – no obvious selective reporting; it is difficult to judge however whether selective reporting is a problem, as no protocol exists.	**Low risk** – no other sources.	**Unclear**

Table S4b. Risk of bias of included studies on banded molars.

Study	Sequence generation	Allocation concealment	Blinding of participants/ personnel	Blinding of outcome assessors	Incomplete outcome data	Selective outcome reporting	Other sources of bias	Overall
Adriaens 1990	**High risk** – no randomization: "Before placement of the orthodontic bands, Fluor Protector® was applied only on the buccal surfaces of the 16 and 46".	**Unclear** – no information provided.	**High risk** – patients and treatment providers were not blinded, but orthodontic treatment providers could have been. Outcome is objective, but has not been assessed blindly.	**High risk** – Outcome is objective, but has not been assessed blindly.	**Low risk** – no drop-outs reported.	**Unclear** – no obvious selective reporting; it is difficult to judge however whether selective reporting is a problem, as no protocol exists.	**Unclear** – data are clustered and this has not been accounted for in the analyses. Also, the risk of effect contamination across randomized mouth quadrants is unclear.	**High risk**
van der Linden 1998	**High risk** – no randomization: "The split mouth technique was used: teeth 16 and 36 as the test, and 26 and 46 as the control".	**Unclear** – no information provided.	**High risk** – patients and treatment providers were not blinded, but orthodontic treatment providers could have been. Outcome is objective, but has not been assessed blindly.	**High risk** – Outcome is objective, but has not been assessed blindly.	**Low risk** – no drop-outs reported.	**Unclear** – no obvious selective reporting; it is difficult to judge however whether selective reporting is a problem, as no protocol exists.	**Unclear** – data are clustered and this has not been accounted for in the analyses. Also, the risk of effect contamination across randomized mouth quadrants is unclear.	**High risk**

Table S5. Results of meta-analyses with at least 2 studies on banded molars.

Experimental group	Control group	Trials	Outcome	Follow-up (mos)	Effect (95% CI)	P	I^2 (95% CI)	τ^2 (95% CI)	95% prediction intervals
F-varnish under cement	No varnish	2	WSL development (tooth-level)	48.0	RR: 0.49 (0.09 to 2.72)	0.42	81% (0 to 100%)	1.23 (0 to 189.92)	-

CI, confidence interval; F, fluoride; mo, month; RR, relative risk; WSL, white spot lesion.x

Table S6a. Details of the GRADE Summary of findings assessment on bracketed teeth.

Comparison	Outcome	Risk of Bias	Inconsistency	Indirectness	Imprecision	Publication bias	Large Effect	Dose Response	Residual Confounding
Reminder vs no reminder	WSL prevalence	Starts from "high", due to the inclusion of randomized studies. Downgraded by two points due to serious limitations (high risk of bias).	Low heterogeneity; no reason to downgrade	Directly relevant; no reason to downgrade	Adequate sample; no reason to downgrade	Safe / not assessable; no reason to downgrade	Large effect, but methodological limitations exist in the included studies.	Not assessable; no reason to upgrade	Residual confounding cannot be excluded; no reason to upgrade.
F-releasing vs conventional adhesive	WSL prevalence	Starts from "high", due to the inclusion of randomized studies. Downgraded by one point due to limitations (high risk of bias).	Same as A	Same as A	Same as A	Same as A	Small effect; no reason to upgrade	Same as A	Same as A
F-releasing vs conventional adhesive	WSL area	Starts from "high", due to the inclusion of randomized studies. The risk of bias is unclear.	Same as A	Same as A	Same as A	Same as A	Same as B	Same as A	Same as A
Glass-ionomer versus resin adhesive	WSL prevalence	Starts from "high", due to the inclusion of randomized studies. Downgraded by two points due to serious limitations (high risk of bias).	Moderate heterogeneity; one study for and two against glass-ionomer adhesive; downgrade by one.	Same as A	Same as A	Same as A	Same as B	Same as A	Same as A
Any sealant versus no sealant	WSL prevalence	Starts from "high", due to the inclusion of randomized studies. Downgraded by two points due to serious limitations (high risk of bias).	Moderate heterogeneity; no reason to downgrade	Same as A	Same as A	Same as A	Same as B	Same as A	Same as A
F-varnish versus no varnish	WSL prevalence	Starts from "high", due to the inclusion of randomized studies. Downgraded by one point due to limitations (high risk of bias).	Large heterogeneity; however, estimaters are imprecise and both studies on the same size of the forest plot; no reason to downgrade	Same as A	Same as A	Same as A	Large effect	Same as A	Same as A
F-varnish versus no varnish	WSL area	Starts from "high", due to the inclusion of randomized studies. Downgraded by two points due to serious limitations (high risk of bias).	Same as A	Same as A	Same as A	Same as A	Same as B	Same as A	Same as A

F, fluoride; GRADE, Grades of Recommendations, Assessment, Development, and Evaluation; WSL, white spot lesion.

Table S6b. Details of the GRADE Summary of findings assessment on banded molars.

Comparison	Outcome	Risk of Bias	Inconsistency	Indirectness	Imprecision	Publication bias	Large Effect	Dose Response	Residual Confounding
F-varnish versus no varnish	WSL prevalence	Starts from "high", due to the inclusion of randomized studies. Downgraded by two points due to serious limitations (high risk of bias).	Large heterogeneity; one study for and one against fluoride varnish; downgrade by one.	Same as A	Sample size most probably inadequate; downgrade by one.	Same as A	Same as B	Same as A	Same as A

Table S7. Summary of findings table according to the GRADE approach on banded molars.

		Anticipated absolute effects[a] (95% CI)				
Outcome Trials (patients)	**Relative effects (95% CI)**	**Control**	**Experimental**	**Difference**	**Quality of the evidence (GRADE)[c]**	**What happens**
		F varnish	No varnish			
WSL development (tth.-level) 48.0 months 176 tth (2 studies)	RR 0.5 (0.09 to 2.72)	25.3%[b]	12.4% (2.3 to 68.8)	12.9% less teeth (23.0 less to 43.5 more) NNT -	⊕◯◯◯ very low[c,d,e] due to bias, inconsistency, imprecision	There might be little to no difference in WSL development on teeth

Interventions for the prevention of WSLs during orthodontic treatment.
Population & intervention: adolescent or adult patients receiving fixed appliance orthodontic treatment.
Settings: university clinics (Belgium).
a The basis for the risk in the control group (e.g., the median control group risk across studies) is provided in footnotes. The risk in the intervention group (and its 95% confidence interval) is based on the assumed risk in the comparison group and the relative effect of the intervention (and its 95% CI).
[b] Response in the control group is based on average event rate of included studies in each case.
[c] Starts from "high", due to the inclusion of randomized studies. Downgraded by two points due to serious limitations (high risk of bias).
[d] Downgraded by one for inconsistency, as one trial favors and the other is against varnish use.
[c] Downgraded for imprecision, as the wide 95% CI includes both large beneficial and large detrimental effects.

CI, confidence interval; F, fluoride; GRADE, Grading of Recommendations Assessment, Development and Evaluation; MD, mean difference; NNT, number needed to treat; NR, not reported; RR, relative risk; Tth, tooth; WSL, white spot lesion.

Table S8. Sensitivity analyses by excluding trials with high risk of bias for the domains of generation of randomization sequence and blinding of outcome assessor.

		Original analysis			Sensitivity analysis: low/unclear risk of bias for randomization			Sensitivity analysis: low/unclear risk of bias for outcome blinding		
Comparison	**Outcome**	**n**	**Effect (95% CI)**	**P**	**n**	**Effect (95% CI)**	**P**	**n**	**Effect (95% CI)**	**P**
Bracketed teeth										
Reminder vs no reminder	WSL development (patient-level)	3	RR: 0.44 (0.31 to 0.64)	<0.001	-	-	-	1	RR: 0.44 (0.20 to 0.94)	0.03
F-releasing adhesive vs conventional adhesive	WSL development (tooth-level)	5	RR: 0.86 (0.70 to 1.07)	0.18	-	-	-	4	RR: 0.87 (0.64 to 1.17)	0.34
F-releasing adhesive vs conventional adhesive	WSL area (tooth-level)	2	MD: -0.23 (-0.85 to 0.38)	0.46	-	-	-	-	-	-
Glass-ionomer adhesive vs resin adhesive	WSL development (tooth-level)	3	RR: 0.81 (0.47 to 1.39)	0.44	1	RR: 0.48 (0.30 to 0.79)	0.004	2	RR: 0.68 (0.30 to 1.55)	0.36
Any sealant vs no sealant	WSL development (tooth-level)	5	RR: 0.77 (0.63 to 0.95)	0.01	3	RR: 0.60 (0.35 to 1.05)	0.07	2	RR: 0.96 (0.78 to 1.18)	0.70
F-varnish vs no varnish	WSL development (patient-level)	2	RR: 0.46 (0.18 to 1.15)	0.10	-	-	-	1	RR: 0.27 (0.13 to 0.54)	<0.001
F-varnish vs no varnish	WSL index (tooth-level)	2	MD: -0.32 (-0.44 to -0.21)	<0.001	-	-	-	-	-	-
Bonded molars										
F-varnish under cement vs no varnish	WSL development (tooth-level)	2	RR: 0.49 (0.09 to 2.72)	0.42	-	-	-	-	-	-

CI, confidence interval; F, fluoride; MD, mean difference; NR, not reported; RR, relative risk; WSL, white spot lesion.

Figure S1. Contour enhanced forest plot on the random-effects meta-analysis of patient reminder versus no reminder (parallel randomized trials of bracketed teeth). CI, confidence interval; Evct, events in control group; Evex, events in experimental group; nct, number in control group; nex, number in experimental group; PrI, predictive interval; RR, relative risk; WSL, white spot lesion.

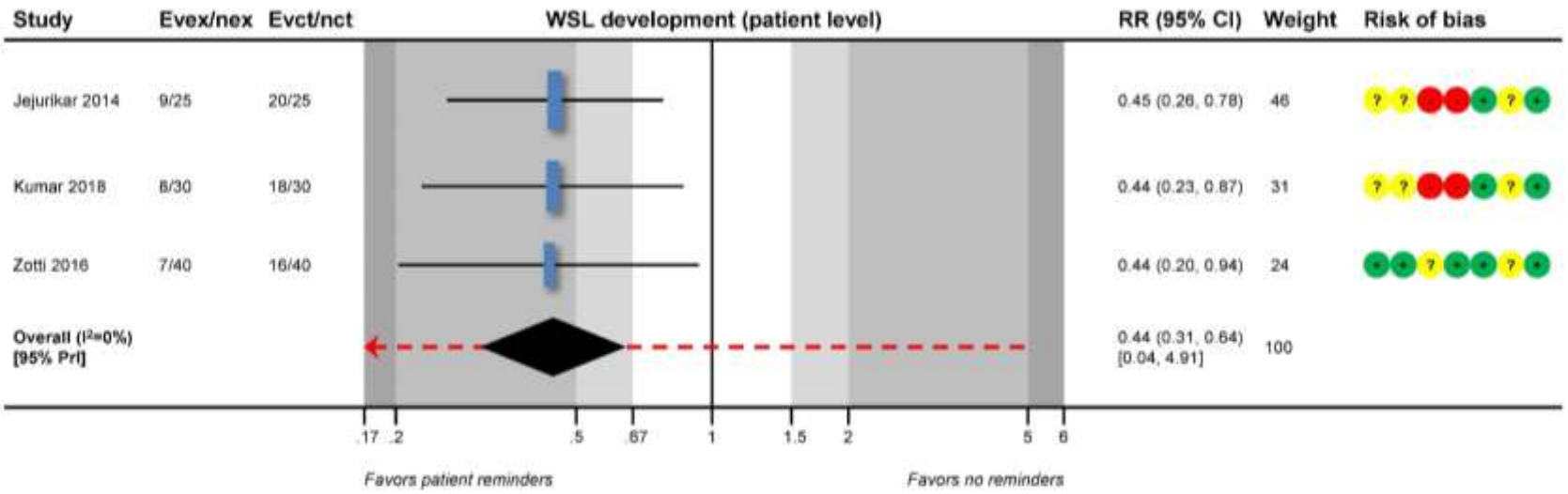


Figure S2. Contour enhanced forest plot on the random-effects meta-analysis of fluoride-releasing adhesive versus conventional adhesive (within-persons randomized trials of bracketed teeth). CI, confidence interval; Evct, events in control group; Evex, events in experimental group; nct, number in control group; nex, number in experimental group; PrI, predictive interval; RR, relative risk; WSL, white spot lesion.

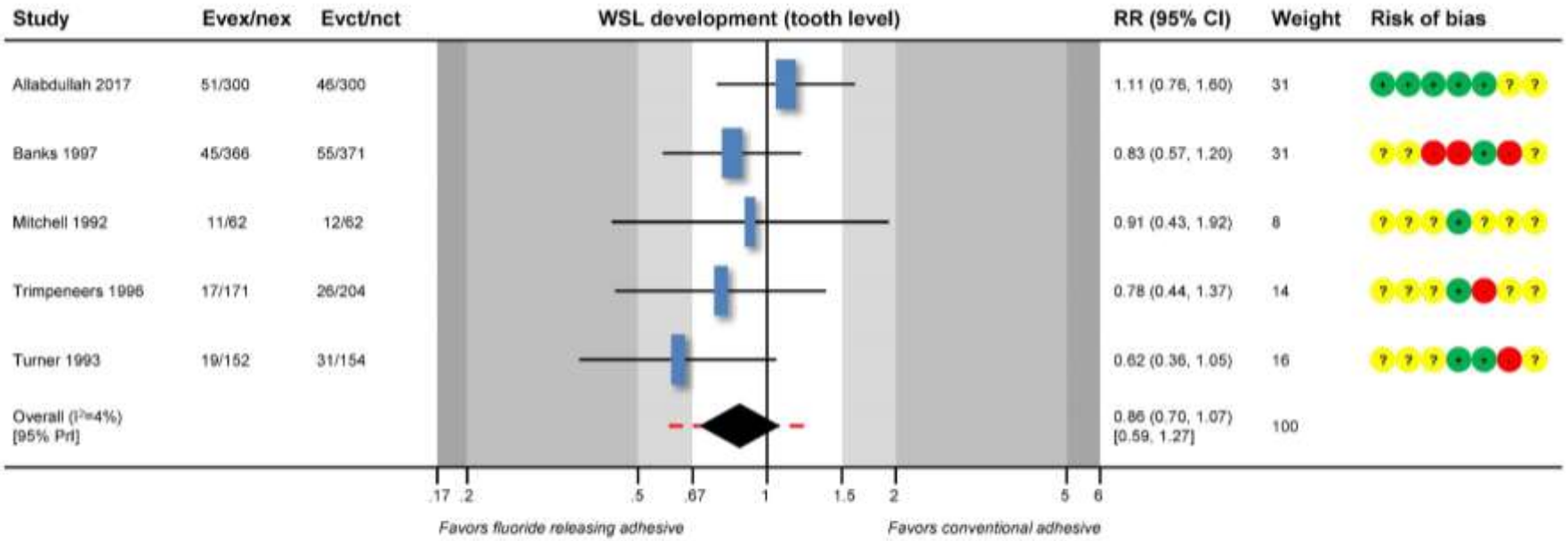


Figure S3. Contour enhanced forest plot on the random-effects meta-analysis of fluoride-releasing adhesive versus conventional adhesive (within-persons randomized trials of bracketed teeth). CI, confidence interval; MD, mean difference; nct, number in control group; nex, number in experimental group; PrI, predictive interval; SD, standard deviation; WSL, white spot lesion.

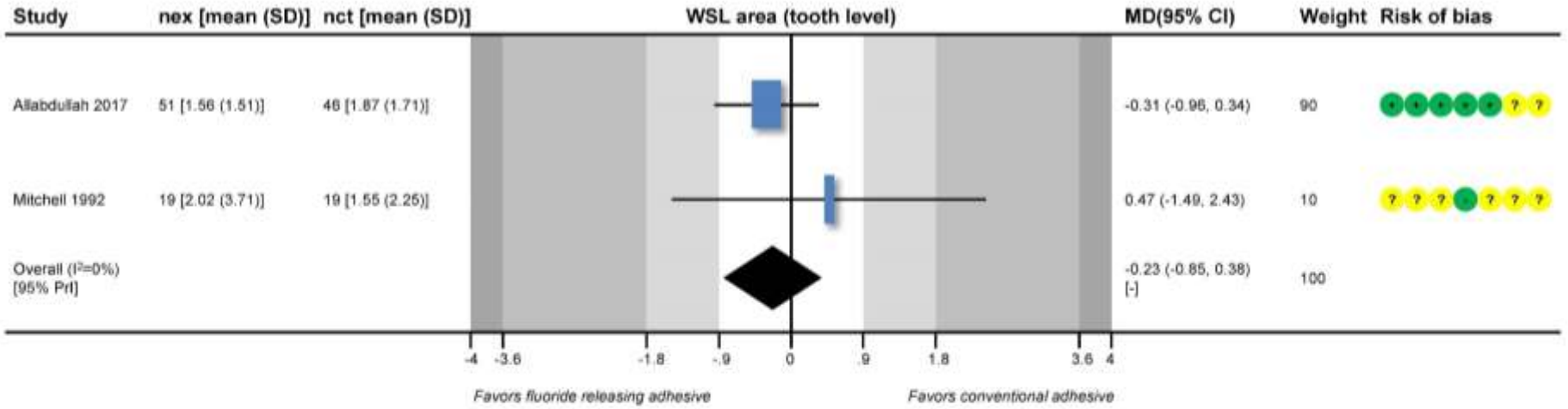


Figure S4. Contour enhanced forest plot on the random-effects meta-analysis of glass-ionomer adhesive versus resin adhesive (within-persons randomized trials of bracketed teeth). CI, confidence interval; Evct, events in control group; Evex, events in experimental group; nct, number in control group; nex, number in experimental group; PrI, predictive interval; RR, relative risk; WSL, white spot lesion.

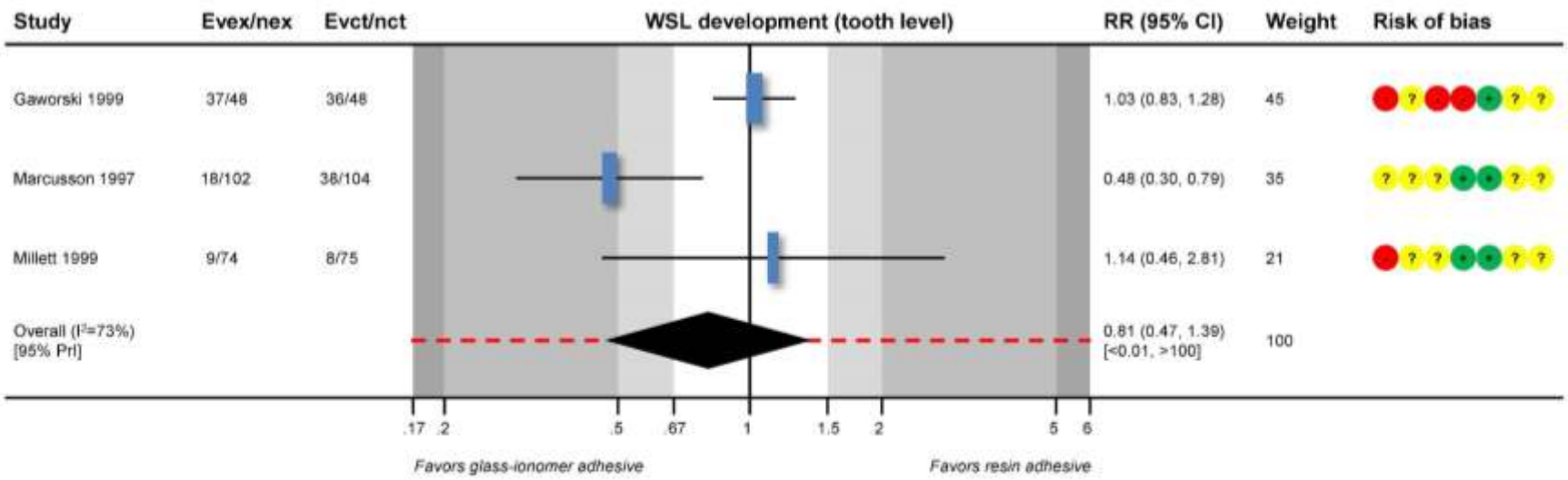


Figure S5. Contour enhanced forest plot on the random-effects meta-analysis of any sealant versus no sealant (within-persons randomized trials of bracketed teeth). CI, confidence interval; Evct, events in control group; Evex, events in experimental group; nct, number in control group; nex, number in experimental group; PrI, predictive interval; RR, relative risk; WSL, white spot lesion.

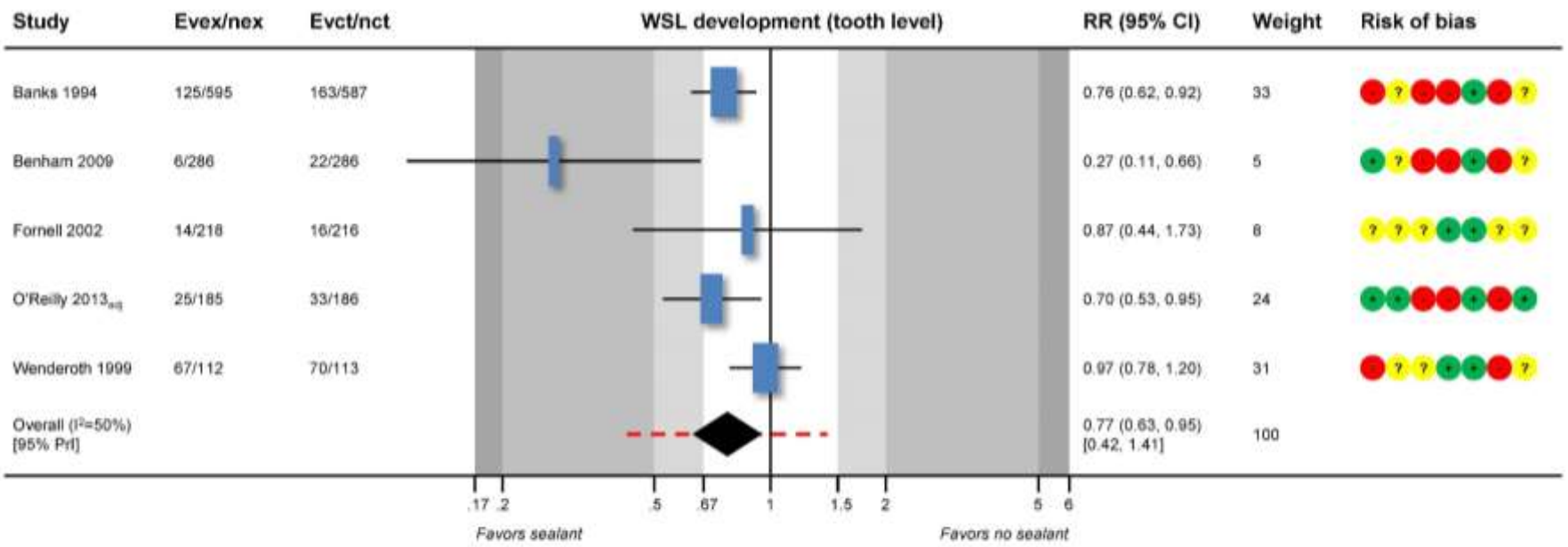


Figure S6. Contour enhanced forest plot on the random-effects meta-analysis of fluoride varnish versus no varnish (within-persons randomized trials of bracketed teeth). CI, confidence interval; Evct, events in control group; Evex, events in experimental group; nct, number in control group; nex, number in experimental group; PrI, predictive interval; RR, relative risk; WSL, white spot lesion.

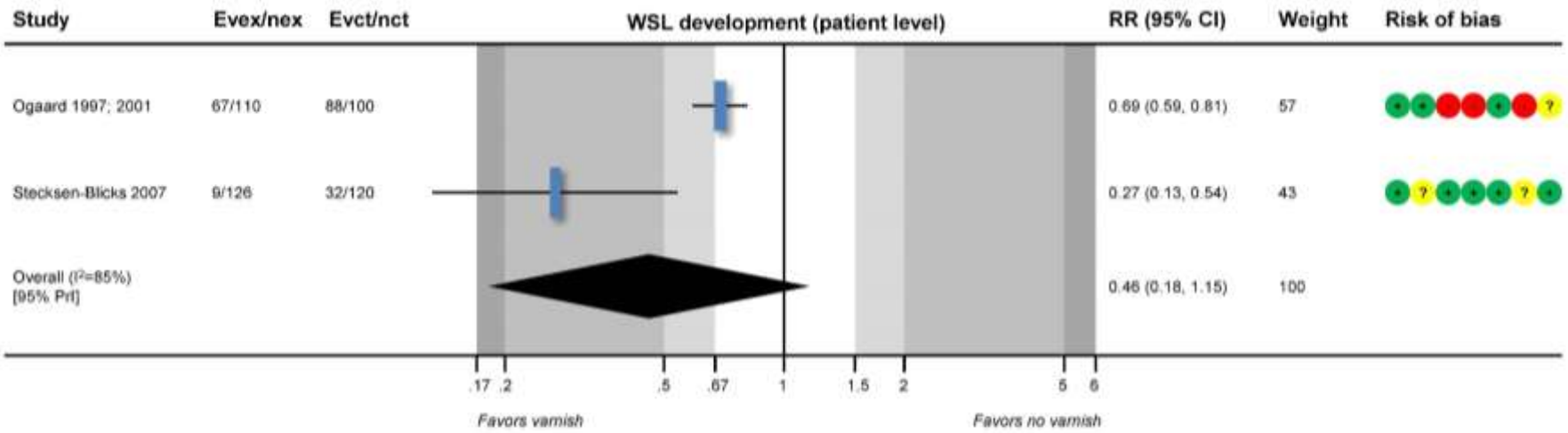


Figure S7. Contour enhanced forest plot on the random-effects meta-analysis of fluoride varnish versus no varnish (within-persons randomized trials of bracketed teeth). CI, confidence interval; Evct, events in control group; Evex, events in experimental group; nct, number in control group; nex, number in experimental group; PrI, predictive interval; RR, relative risk; WSL, white spot lesion.

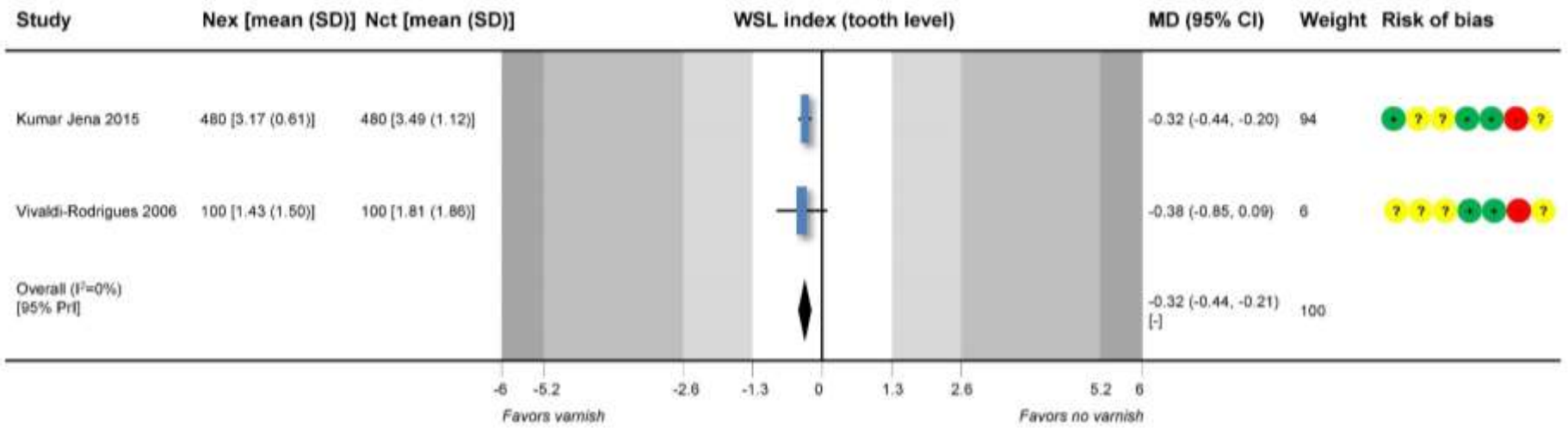


Figure S8. Contour enhanced forest plot on the random-effects meta-analysis of fluoride varnish under cement versus no varnish under cement (within-persons randomized trials of banded molars).